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FAMILIES OF SPERMATOPHYTES IN THE FLORA OF PANAMA

Each family of the Flora of Panama by Robert E. Woodson, Jr. and Robert W. Schery and Collaborators will be numbered as indicated below. This will make it possible to publish the manuscripts as soon as they are completed and edited. Families which have appeared in the Flora are printed in *italics*.

1. *Cycadaceae*
2. *Taxaceae*
3. *Typhaceae*
4. *Alismaceae*
5. *Butomaceae*
6. *Triuridaceae*
7. *Gramineae*
8. *Cyperaceae*
9. *Palmaceae*
10. *Cyclanthaceae*
11. *Araceae*
12. *Lemnaceae*
13. *Mayacaceae*
14. *Xyridaceae*
15. *Eriocaulaceae*
16. *Rapateaceae*
17. *Bromeliaceae*
18. *Commelinaceae*
19. *Pontederiaceae*
20. *Juncaceae*
21. *Liliaceae*
22. *Smilacaceae*
23. *Haemodoraceae*
24. *Amaryllidaceae*
25. *Velloziaceae*
26. *Dioscoreaceae*
27. *Iridaceae*
28. *Burmanniaceae*
29. *Musaceae*
30. *Zingiberaceae*
31. *Cannaceae*
32. *Marantaceae*
33. *Orchidaceae*
34. *Piperaceae*
35. *Chloranthaceae*
36. *Lacistemaceae*
37. *Salicaceae*
38. *Myricaceae*
39. *Juglandaceae*
40. *Corylaceae*
41. *Fagaceae*
42. *Ulmaceae*
43. *Moraceae*
44. *Urticaceae*
45. *Proteaceae*
46. *Loranthaceae*
47. *Opiliaceae*
48. *Olacaceae*
49. *Balanophoraceae*
50. *Aristolochiaceae*
51. *Polygonaceae*
52. *Chenopodiaceae*
53. *Amaranthaceae*
54. *Nyctaginaceae*
55. *Batidaceae*
56. *Phytolaccaceae*
57. *Aizoaceae*
58. *Portulacaceae*
59. *Caryophyllaceae*
60. *Nymphaeaceae*
61. *Ceratophyllaceae*
62. *Ranunculaceae*
63. *Berberidaceae*
64. *Menispermaceae*
65. *Magnoliaceae*
66. *Winteraceae*
67. *Annonaceae*
68. *Myristicaceae*
69. *Monimiaceae*
70. *Lauraceae*
71. *Hernandiaceae*
72. *Papaveraceae*
73. *Capparidaceae*
74. *Cruciferae*
75. *Resedaceae*
76. *Moringaceae*
77. *Crassulaceae*
78. *Podostemonaceae*
79. *Saxifragaceae*
80. *Cunoniaceae*
81. *Rosaceae*
82. *Connaraceae*
83. *Leguminosae* in part
84. Oxalidaceae
85. Geraniaceae
86. Tropaeolaceae
87. Erythroxylaceae
88. Zygophyllaceae
89. Rutaceae
90. Simaroubaceae

91. Burseraceae
92. Meliaceae
93. Malpighiaceae
94. Trigoniaceae
95. Vochysiaceae
96. Polygalaceae
97. Euphorbiaceae
98. Callitrichaceae
99. Buxaceae
100. Coriariaceae
101. Anacardiaceae
102. Aquifoliaceae
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104. Hippocrateaceae
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124. Cistaceae
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127. Violaceae
128. Flacourtiaceae
129. Turneraceae
130. *Passifloraceae*
131. *Caricaceae*
132. *Loasaceae*
133. *Begoniaceae*
134. *Cactaceae*
135. *Thymelaeaceae*
136. *Lythraceae*
137. *Lecythidaceae*
138. *Rhizophoraceae*
139. *Combretaceae*
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141. *Melastomataceae*
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143. *Haloragidaceae*
144. *Araliaceae*
145. *Umbelliferae*
146. *Cornaceae*
147. Clethraceae
148. Pyrolaceae
149. Ericaceae
150. Myrsinaceae
151. Theophrastaceae
152. Primulaceae
153. Plumbaginaceae
154. Sapotaceae
155. Ebenaceae
156. Styracaceae
157. Symplocaceae
158. Oleaceae
159. Loganiaceae
160. Gentianaceae
161. Menyanthaceae
162. Apocynaceae
163. Asclepiadaceae
164. Convolvulaceae
165. Polemoniaceae
166. Hydrophyllaceae
167. Boraginaceae
168. Verbenaceae
169. Labiatae
170. Solanaceae
171. Scrophulariaceae
172. Bignoniaceae
173. Pedaliaceae
174. Orobanchaceae
175. Gesneriaceae
176. Lentibulariaceae
177. Acanthaceae
178. Plantaginaceae
179. Rubiaceae
180. Caprifoliaceae
181. Valerianaceae
182. Cucurbitaceae
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FLORA OF PANAMA[1]

Part VI

FAMILY 114. TILIACEAE[2]

BY ANDRÉ ROBYNS[3]

Trees or shrubs, infrequently herbs, mucilaginous, generally with stellate hairs, sometimes with simple hairs or lepidote. *Leaves* alternate, rarely opposite, simple, entire to more or less deeply lobed, generally stipulate, the stipules usually paired, equal or not and often fugacious. *Inflorescences* axillary or terminal, rarely oppositifolious, cymose or paniculate or flowers solitary, sometimes cauliflorous. *Flowers* generally bracteolate, small or large, hermaphrodite, sometimes imperfect, generally actinomorphous, sometimes calyculate; calyx usually valvate, seldom imbricate, gamo- or polysepalous, the sepals (2-3-)4-5(-6-8), caducous, persistent or accrescent; petals 4-5, sometimes sepaloid, rarely absent, contorted, imbricate or valvate, usually free, often glandular at the base; stamens inserted on the receptacle or on a gonophore, usually numerous, rarely 10 or less, sometimes partially staminodial in the hermaphrodite flowers, staminodial or absent in the pistillate ones, free or shortly connate at the base into a tube or into 5 or 10 phalanges; anthers usually 2-thecate, longitudinally dehiscent or apically porose; pollen generally 3-colporate, with reticulate or tegillate sexine; gynoecium with (1-)2-5(-10) syncarpous carpels, infrequently with 5-6 apocarpous carpels; ovary usually superior, rarely subinferior to inferior, sessile on the receptacle or on the gonophore, sometimes borne on a gynophore, (1-)2- to many-celled (cells sometimes divided by false partitions), with (1-)2-many ovules in each cell and generally with axile placentation, infrequently with parietal placentation; ovules

1. The Flora of Panama by Robert E. Woodson, Jr. and Robert W. Schery and Collaborators should be cited as: Ann. Missouri Bot. Gard., with volume number, pagination and date of the Annals.

2. Assisted by National Science Foundation Grants No. G-7144 (Principal Investigator, R. E. Woodson, Jr.) & GB-170 (Principal Investigator, H. C. Cutler).

3. I wish to express my sincere thanks and appreciation to the directors and curators of the following herbaria for the loan of material and facilities for study: Arnold Arboretum, Chicago Natural History Museum, Gray Herbarium, New York Botanical Garden and United States National Herbarium.

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anatropous; style usually simple; stigma entire or more or less 2- to 10-divided. *Fruit* baccate, drupaceous or capsular, smooth or spinose, sometimes alate, variously dehiscent or indehiscent, rarely divided into cocci; seeds 1-many, the testa sometimes alate, pilose or arillate; albumen abundant or scanty; embryo straight or slightly curved; cotyledons foliaceous, seldom carnose.

A family of about 50 genera chiefly of tropical distribution, but with some extensions into the temperate regions; nine genera are represented in Panama, while two others occur in Central America, namely: *Carpodiptera* Griseb. and *Christiana* DC. The bast of many species yields a good fibre, as for example the hemp or jute produced by some species of *Corchorus*.

a. Stipules equal, not peltate; perianth and androecium hypoginous; sepals without appendages or with a small apical appendage only; ovary superior.

- b. Fruit unarmed.
  - c. Petals glandular-thickened within at the base.
    - d. Petals longer or somewhat shorter than the sepals; capsules.
      - e. Flowers hermaphrodite, calyculate; petals longer than the sepals; gonophore absent; capsules ligneous, imperfectly loculicidally 5-valvate; seeds broadly winged .... 1. LUEHEA
      - ee. Flowers imperfect, without calycle; petals somewhat shorter than the sepals; gonophore present; capsules coriaceous, compressed contrary to the partition, loculicidally 2-valvate; seeds long-ciliate along the margins .... 2. TRICHOSPERMUM
    - dd. Petals about half the length of the sepals; fruit composed of 3(-4) samaras; flowers hermaphrodite, calyculate .... 3. GOETHALSIA
  - cc. Petals eglandular; flowers hermaphrodite.
    - f. Capsules chartaceous or coriaceous-chartaceous, elongate, silique-like, loculicidally 2- or 3-valvate; seeds not arillate .... 4. CORCHORUS
    - ff. Capsules ligneous, more or less globose, loculicidally 5-valvate; seeds arillate .... 5. MORTONIODENDRON
- bb. Fruit armed with spines or bristles.
  - g. Flowers hermaphrodite; gonophore absent; anthers with a membranous appendage at the top; capsules transversely elliptic, 1.5-4 cm. long and 5.5-8 cm. broad, densely bristly or spinose .... 6. APEIBA
  - gg. Flowers hermaphrodite or pistillate; anthers without appendage; fruit capsular, less than 2 cm. in diam.
    - h. Flowers 4-merous; gonophore eglandular; fruit laterally compressed and with 2 rows of long plumose bristles along the margins .... 7. HELIOCARPUS
    - hh. Flowers 5-merous; gonophore when present glandular; fruit not compressed, covered on all sides with spines topped by hyaline spinules .... 8. TRIUMFETTA

aa. Stipules unequal, one filiform, the other large, peltate and foliaceous; perianth and androecium subepiginous; sepals provided along the margins and at the apex with long filiform appendages; ovary subinferior to inferior .... 9. DICRASPIDIA

1. LUEHEA Willd.

LUEHEA Willd., Gesells. Naturf. Freunde Berlin, Neue Schr. **3:** 410. 1801.

Alegria Moç. & Sesse ex DC., Prodr. **1:** 516. 1824.
Brotera Vell., Fl. Flum. 302. 1825, Fl. Flum. Ic. **7:** *t.163-164*. 1835.

Trees or tall shrubs, the trunk sometimes buttressed, the pubescence of stellate hairs. *Leaves* alternate, shortly petiolate, the stipules paired and mostly deciduous, the blade usually serrate, 3- to 5-palminerved. *Inflorescences* axillary or terminal, cymose or thyrsiform, sometimes flowers solitary. *Flowers* hermaphrodite, actinomorphous, pedicellate, bracteolate, calyculate, the bractlets 9-17, sometimes more or less long-connate at the base, mostly deciduous or rarely persistent; calyx valvate, the sepals 5, free or rarely shortly connate at the base, deciduous; petals 5, free, imbricate, longer than the sepals, glandular-thickened within at the base; stamens numerous, shortly 5- to 10-adelphous, the phalanges seldom united into a very short staminal tube, the outer stamens staminodial; anthers 2-thecate, extrorse, more or less medifixus, versatile or seldom erect, longitudinally dehiscent; ovary superior, usually sessile, infrequently very short-stipitate, 5-celled, the cells many-ovulate; style simple, thick, somewhat enlarged near the apex; stigma capitate. *Capsules* ligneous, imperfectly loculicidally 5-valvate; seeds numerous, small, the testa crustaceous, expanded above into a large membranous wing; albumen carnose; embryo straight; cotyledons plane, foliaceous.

A neotropical genus of about 20 species; three species are found in Central America and Panama.

a. Flowers solitary, large, 4.7-5.3 cm. long; bractlets 10-17, more or less long-connate at the base; capsule deeply 5-sulcate and prominently 5-angled, 6-7 cm. long .... 1. L. CANDIDA

aa. Flowers in axillary or terminal panicles; bractlets 9, free.

b. Flowers ca. 3.2 cm. long; capsule more or less 5-angled, 3-3.5 cm. long .... 2. L. SPECIOSA

bb. Flowers ca. 1.3 cm. long; capsule deeply 5-sulcate and prominently 5-angled, 2-2.5 cm. long .... 3. L. SEEMANNII

1. LUEHEA CANDIDA (Moç. & Sesse ex DC.) Mart. & Zucc. in Mart., Nov. Gen. Sp. Pl. **1:** 102. 1826; Johnston, Sargentia **8:** 192. 1949.

Alegria candida Moç. & Sesse ex DC., Prodr. **1:**517. 1824.
Luehea mexicana Spach, Hist. Nat. Veg. **4:** 42. 1835.
Luehea scabrifolia Presl, Epimeliae Botanicae 212. 1849.
Luehea endopogon Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 225. 1858.
Luehea nobilis Linden & Planchon, Pl. Columb. 52. 1863.

Tree, small, or sometimes large shrub, 5-20 m. high, deciduous, the trunk attaining 25-30 cm. in diam., the crown broad, the branchlets ferruginous-arachnoid. *Leaves* thick-petiolate, the petiole 0.6-1 cm. long, tomentellous, the stipules elliptic, long-acuminate, up to 1.4-2 cm. long and villous-puberulous especially without, the blade broadly elliptic, more or less rounded and sometimes somewhat cordate at the base, acuminate at the apex, 8-22 cm. long and 6-16 cm. wide, the margins

coarsely or finely serrate, green and sparsely scabrous above, grayish or whitish and more or less densely arachnoid beneath, 3-palminerved, the nervation prominent especially beneath. *Flowers* solitary (sometimes geminate?), large, 4.7-5.3 cm. long, the pedicel terete, enlarged at the apex, 1-2 cm. long, tomentellous; bractlets 10-17, more or less long-connate at the base, narrowly oblong-lanceolate, dorsal-carinate, long-acuminate, up to 3.3-4.5 cm. long and 0.5 cm. wide, fleshy, tomentellous without, densely sericeous within, persistent; sepals oblong-lanceolate, shortly connate at the base, acute at the apex, up to 4.2-4.6 cm. long and 1.25 cm. wide, fleshy, tomentellous outside, glabrous inside except the sericeous base; petals spatulate-obovate, acuminate or acute, up to 4.7-5.3 cm. long and 2.5-3 cm. wide, white or cream-colored, glabrous except the hirsute base; stamens shortly 5-adelphous, the phalanges connate into a very short staminal tube, sericeous to hirsute on the lower part; anthers oblong, ca. 2.5 mm. long; ovary shortly stipitate, the gynophore ca. 1 mm. long, ovoid, deeply 5-sulcate, ca. 0.5 cm. long and 0.55 cm. in diam., densely sericeous; style ca. 1.8 cm. long, tomentellous; stigma capitate, obscurely 5-lobulate. *Capsule* very ligneous, deeply 5-sulcate and prominently 5-angled, rounded at the base, acute at the apex, 6-7 cm. long and ca. 3.5 cm. in diam., tomentellous when young to glabrate when mature; seeds more or less elliptic, flattened, ca. 6 mm. long and 3 mm. wide, the wing 15 mm. long and 6 mm. wide.

Along the Pacific slope from Mexico to Panama, northern Colombia and Venezuela; mostly on dry, thin soils on woody or brushy hillsides, sometimes along stream beds.

COCLÉ: between Aguadulce and Antón, ca. 15-50 m., *Woodson, Allen & Seibert 1203*. LOS SANTOS: Los Santos, *Dwyer 1185*. PANAMA: San José Island, *Erlanson 455, 463, Johnston 153*.

2. Luehea speciosa Willd., Gesells. Naturf. Freunde Berlin, Neue Schr. **3:** 410, *t.5.* 1801.

Luehea platypetala A. Rich., Bot., Pl. Vasc. in Ramon de la Sagra, Hist. Phys. Pol. Nat. Cuba 212. 1845, *t.23* 1850(?).
Luehea ferruginea Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 224. 1958.

Tree, medium-sized, sometimes shrub, 5-18(-20) m. high, deciduous, the trunk attaining 50 cm. in diam., the crown spreading, the branchlets ferruginous-puberulous. *Leaves* thick-petiolate, the petiole 1-1.2 cm. long, densely arachnoid, the blade elliptic, sometimes narrowly elliptic, rounded to more or less cordate and slightly asymmetric at the base, acuminate at the apex, 10-18 cm. long and 4.3-11 cm. wide, subcoriaceous, the margins coarsely serrate, green and sparsely scabrous above, whitish or grayish and loosely arachnoid beneath, 3-palminerved, the nervation prominent beneath. *Inflorescences* in axillary or terminal panicles. *Flowers* ca. 3.2 cm. long, the pedicel terete, 1.5-3.5 cm. long, shortly tomentellous; bractlets 9(-10), free, narrowly oblong-lanceolate, acute, 1.8-2 cm. long and 0.35-0.4 cm. wide, fleshy, shortly tomentellous on both sides, deciduous; sepals free, oblong-lanceolate, acute, ca. 2.9 cm. long and 0.75-0.9 cm. wide, fleshy, shortly tomentellous without, glabrous within; petals obovate, rounded, 3.1-3.2 cm.

long and 1.1-1.3 cm. wide, glabrous except the inner villous base; stamens shortly 5-adelphous, hirsute on the lower part, the staminodes ca. 10 mm. long and connate at the base; anthers ca. 1 mm. long; ovary sessile, oblong-ovoid, slightly 5-sulcate, ca. 0.6 cm. long and 0.4 cm. in diam., densely sericeous; style ca. 1.5 cm. long, more or less tomentellous on the lower part; stigma capitate. *Capsule* hard-ligneous, oblong, more or less 5-angled, rounded at the base, obtuse at the apex, 3-3.5 cm. long and 1.2-1.6 cm. in diam., tomentose; seeds ellipsoid, flattened, ca. 4-5 mm. long and 2-2.5 mm. in diam., the wing ca. 5 mm. long and 4 mm. wide.

Tropical Central America, Cuba, Colombia and Brazil; in open sunlight, on edges of pastures, in dry or sometimes more or less moist thickets and forests.

CANAL ZONE: around Culebra, alt. 50-150 m., *Pittier 2141, 4811;* Chiva-Chiva trail, Red Tank to Pueblo Nuevo, *Piper 5717;* Balboa, *Johansen 4, Standley 25583, 26986;* Balboa, near the Baptist Church, *Harvey 5025;* Ancon Hill, *J.M. & M.T. Greenman 5086;* Hospital Grounds at Ancon, 20-30 m., *Pittier 2731;* vicinity of Miraflores, *P. & G. White 58;* drowned forest of Quebrada Bonita and along its branches, 70-80 m., *Dodge, Steyermark & Allen 17174;* locality unknown, *Harvey 5139.* COCLÉ: Penonomé and vicinity, *R.S. Williams 209, 1153.* COLÓN: between France Field, Canal Zone and Catival, *Standley 30412.* HERRERA: vicinity of Ocú, 100 m., *Allen 4093.* PANAMA: near Panama, *Sargent 23;* Río Tapía, *Standley 28080;* along road between Panama and Chepo, *Dodge, Hunter, Steyermark & Allen 16642;* Taboga Island, *Bro. Celestine 39, MacBride 2828;* San José Island, *Johnston 1283.*

3. LUEHEA SEEMANNII Triana & Planchon, Ann. Sci. Nat., Bot., ser. 4, **17:** 348. 1862; Johnston, Sargentia **8:** 193. 1949.—Fig. 1.

Tree, tall, commonly 15-30 m. high or even more, evergreen, the trunk attaining 2 m. in diam., often strongly buttressed, the buttresses up to 2 m. in height, the branchlets tomentose. *Leaves* rather thick-petiolate, the petiole 0.8-1.3 cm. long and ca. 0.2-0.3 cm. in diam., tomentellous, the blade oblong or oblong-elliptic, sometimes slightly oblong-obovate, rounded and asymmetric at the base, acuminate at the apex, 7-40 cm. long and 3-15.5 cm. wide, subcoriaceous, the margins irregularly and acutely serrate especially above the middle, green and loosely arachnoid to glabrescent above, brownish-arachnoid beneath, 3(-4)-palminerved, the nervation prominent beneath. *Inflorescences* of axillary or terminal thyrses. *Flowers* rather small, ca. 1.3 cm. long, the pedicel 0.9-1.2 cm. long and shortly tomentellous; bractlets 9, free, narrowly elliptic, acute, ca. 7 mm. long and 1.25-2 mm. wide, fleshy, shortly tomentellous on both sides, deciduous; sepals free, oblong-lanceolate, acute, ca. 11 mm. long and 3.5 mm. wide, fleshy, shortly tomentellous without, glabrous within; petals spatulate, ca. 13 mm. long and 4.5 mm. wide, white or yellow, glabrous except the inner minutely hirsute base; stamens 5-adelphous, the phalanges ca. 9 mm. long, the united base of each phalanx ca. 2-2.5 mm. long and shortly tomentellous; anthers ca. 1 mm. long; ovary sessile, pyriform, deeply 5-sulcate, ca. 4.5 mm. long and 3.5 mm. in diam., densely sericeous; style ca. 5 mm. long, shortly tomentellous; stigma capitate and obscurely 5-lobulate. *Capsule* ligneous, narrowly elliptic, contracted towards both ends, deeply 5-sulcate and with 5 prominent angles, 2-2.5 cm. long and ca. 1 cm. in diam., shortly brownish-tomentellous; seeds more or less oblong, ca. 2.5-3 mm. long and 1 mm. wide, the wing ca. 8 mm. long and 3 mm. wide.

Figure 1. Luehea Seemannii Triana & Planchon: A, flowering branch (× ½); B, flower-bud (× 3); C, flower (× 1½); D, gynoecium (× 3); E, cross-section of ovary (× 3); F, capsule (× 1); G, seed (× 2).

A giant tree dispersed throughout tropical Central America and in Colombia; common in wet lowland forests along streams.

BOCAS DEL TORO: region of Almirante, *Cooper 19a;* Changuinola Valley, *Cooper & Slater 19, Dunlap 47;* Isla Colón, *von Wedel 40;* Old Bank Island, vicinity of Chiriqui Lagoon, *von Wedel 1967*. CANAL ZONE: along banks of Quebrada Fea, Q. Pura and Cañon of River Chagres, 70-100 m., *Dodge & Allen 17407;* Gatun, *Hayes 467, 819, Ostenfeld 56;* near Gatun, *Goldman 1862;* along the Chagres River below Gatun, near sea level, *Pittier 2812;* Barro Colorado Island, *Bangham 380, Brown 64, 183, Shattuck 745, Wetmore & Abbe 152, Wilson 18, Woodworth & Vestal 336, 446, 513;* Río Grande, near Culebra, alt. 50-100 m., *Pittier 2523;* near Miraflores, *J.M. & M.T. Greenman 5175;* vicinity of Río Cocoli, Road K-9, *Stern, Chambers, Dwyer, Ebinger 34;* vicinity of Corozal, *Piper 5300;* Curundu, *Harvey 5231;* Hospital Grounds at Ancon, alt. 20-30 m., *Pittier 2732*. COLÓN: between France Field, Canal Zone and Catival, *Standley 30360;* Río Gatuncillo, vicinity of Santa Rosa, alt. 25 m., *Allen 4157*. DARIEN: Marraganti and vicinity, *R. S. Williams 635;* vicinity of Pinogana, 20 m., *Allen 4291;* vicinity of El Real, Río Tuira, on trail between El Real and Pinogana, *Stern, Chambers, Dwyer, Ebinger 283*. HERRERA: vicinity of Ocú, 100 m., *Allen 4095*. PANAMA: vicinity of Arraijan, *Allen 1626;* Agricultural Experiment Station at Matias Hernández, *Pittier 6928;* Juan Díaz, *Standley 30560;* near Chepo, *Kluge 24;* San José Island, *Johnston 506, 633, 1222, 1380*. VERAGUAS: locality unknown, *Seemann s.n.* (type). PROVINCE UNKNOWN: *Hayes 978, 1031*.

2. TRICHOSPERMUM Blume

TRICHOSPERMUM Blume, Bijdr. Fl. Ned. Ind. 56. 1825.

Eroteum Blanco, Fl. Filip. ed. 1, 440. 1837.
Belotia A. Rich., Bot., Pl. Vasc. in Ramon de la Sagra, Hist. Phys. Pol. Nat. Cuba 207. 1845.
Diclidocarpus A. Gray, Bot., Phanerog. in U. S. Expl. Exped., 1838-42, **15**: 200. 1854.
Bixagrewia Kurz, Jour. Bot. **13**: 325. 1875.
Halconia Merrill, Philipp. Jour. Sci. **2**: 281. 1907.

Trees, the pubescence of stellate hairs. *Leaves* alternate, petiolate, stipulate, the stipules large and deciduous, the blade entire or serrate to serrulate, 3-palminerved. *Inflorescences* unisexual or androgynous, of axillary or terminal panicles or umbelliform cymes. *Flowers* imperfect, actinomorphous, pedicellate, bracteolate, the bractlets caducous, (4-)5-merous; calyx valvate, the sepals free; petals free, imbricate, somewhat shorter than the sepals, glandular-thickened within at the base, rounded to more or less lobulate at the apex; gonophore naked, crowned by an undulate and densely velutinous urceolus surrounding the base of the stamens; stamens numerous, staminodial in the female flowers, the filaments free; anthers 2-thecate, introrse, medifixus, longitudinally dehiscent; ovary superior, sessile, 2(-3)-celled, rudimentary in the male flowers, the cells many-ovulate; style simple, obsolete in the male flowers; stigma bilobulate. *Capsules* coriaceous, compressed contrary to the partition, the margins sometimes expanded into a small wing, loculicidally 2(-3)-valvate, the cells many-seeded; seeds rather small, broadly ellipsoid, somewhat flattened, long-ciliate along the margins; albumen copious; embryo straight; cotyledons flat.

A tropical genus of America and Asia. Only one of the three American species is reported from Panama.

In a recent paper, Kostermans (Reinwardtia **6:** 277-279. 1962), discussing the affinities of the American genus *Belotia* and the Asiatic *Trichospermum*, concludes that they are congeneric and I agree with this opinion (for details, see the publication cited above).

Sprague (Kew Bull. 1921: 270-278. 1921), in a revision of the American species of the genus (under the name of *Belotia*), recognized eleven species based principally on very variable characters, such as the form and the pubescence of the leaves. Later, Bullock (Kew Bull. 1939: 517-521. 1939) reduced the number of American species to seven. My study of the Panamanian material has caused me to reduce further the number of these species to three, namly: *T. grewiaefolium* (A. Rich.) Kosterm. [syn. *Belotia Lessertiana* Hochr., *T. caribaeum* (Sprague) Kosterm., *B. Campbellii* Sprague and *T. tabascanum* (Sprague) Kosterm.], *T. mexicanum* (DC.) Baill. and probably *T. insigne* (Baill.) Kosterm.; this was originally suggested by Standley and Steyermark in the Flora of Guatemala (Fieldiana: Bot. **24**(6): 305. 1949).

1. Trichospermum mexicanum (DC.) Baill., Hist. Pl. **4:** 179. 1873.—Fig. 2.

Grewia mexicana DC., Prodr. **1:** 510. 1824.
Belotia Galeottii Turcz., Bull. Soc. Imp. Nat. Moscou **19**(2): 504. 1846.
Belotia mexicana (DC.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. **3**(6): 28. 1890.
Belotia panamensis Pittier, Repert. Sp. Nov. **13:** 313. 1914.
Belotia macrantha Sprague, Kew Bull. 1921: 274. 1921.
Belotia grandifolia Sprague, loc. cit. 275. 1921.
Belotia reticulata Sprague, loc. cit. 277. 1921.
Belotia australis Little, Jour. Wash. Acad. Sci. **38:** 99, *fig. 1.* 1948.
Belotia colombiana Cuatr., Rev. Acad. Colomb. Cienc. **8:** 480. 1952.
Belotia occidentalis Cuatr., loc. cit. 481. 1952.
Trichospermum australis (Little) Kosterm., Reinwardtia **6:** 278. 1962.
Trichospermum colombianum (Cuatr.) Kosterm., loc. cit. 278. 1962.
Trichospermum Galeottii (Turcz.) Kosterm., loc. cit. 278. 1962.
Trichospermum grandifolium (Sprague) Kosterm., loc. cit. 279. 1962.
Trichospermum macranthum (Sprague) Kosterm., loc. cit. 279. 1962.
Trichospermum occidentalis (Cuatr.) Kosterm., loc. cit. 279. 1962.
Trichospermum reticulatum (Sprague) Kosterm., loc. cit. 279. 1962.

Tree, 6-15(-27) m. high, the trunk 18-50 cm. in diam., the bark smooth, grayish, the branches spreading, arachnoid to puberulous. *Leaves* with terete petioles (0.8-)1-2.2 cm. long, puberulous to tomentose, the blade oblong or oblong-lanceolate or oblong-obovate, rounded or obtuse at the base, long-acuminate at the apex, 7-20 cm. long and 2.5-9 cm. wide, chartaceous to subcoriaceous, discolor, the margins remotely serrulate, the upper surface scatteringly short-puberulous, the lower surface spreading-puberulous or appressed-puberulous to tomentellous or with both tiers of hairs, often with long hirsute stellate hairs at the base of the 3 main nerves and in the axils of the lateral nerves, the secondary nervation reticulate and prominent beneath. *Inflorescences* unisexual or androgynous, of axillary or terminal, many-flowered panicles, shorter than the leaves, the axes shortly tomentellous. *Flowers* with a pedicel 3-9 mm. long, the sepals narrowly oblong to narrowly oblong-lanceolate, acute and cucullate, 9.5-14 mm. long and 2.5-3.2 mm. wide, pinkish, 3- to 5-nerved, minutely puberulous to tomentellous outside, glabrous or

scatteringly puberulous inside; petals narrowly obovate-oblong to linear-oblong, rounded or emarginate or undulate to lobulate, 8-12 mm. long and 1-3 mm. wide, purplish, scatteringly puberulous with simple and stellate hairs without, velutinous around and above the gland within, the gland ca. 1 mm. in diam.; gonophore ca. 1.5-2 mm. long, glabrous, the urceolus ca. 3-4 mm. broad; stamens 15, the filaments

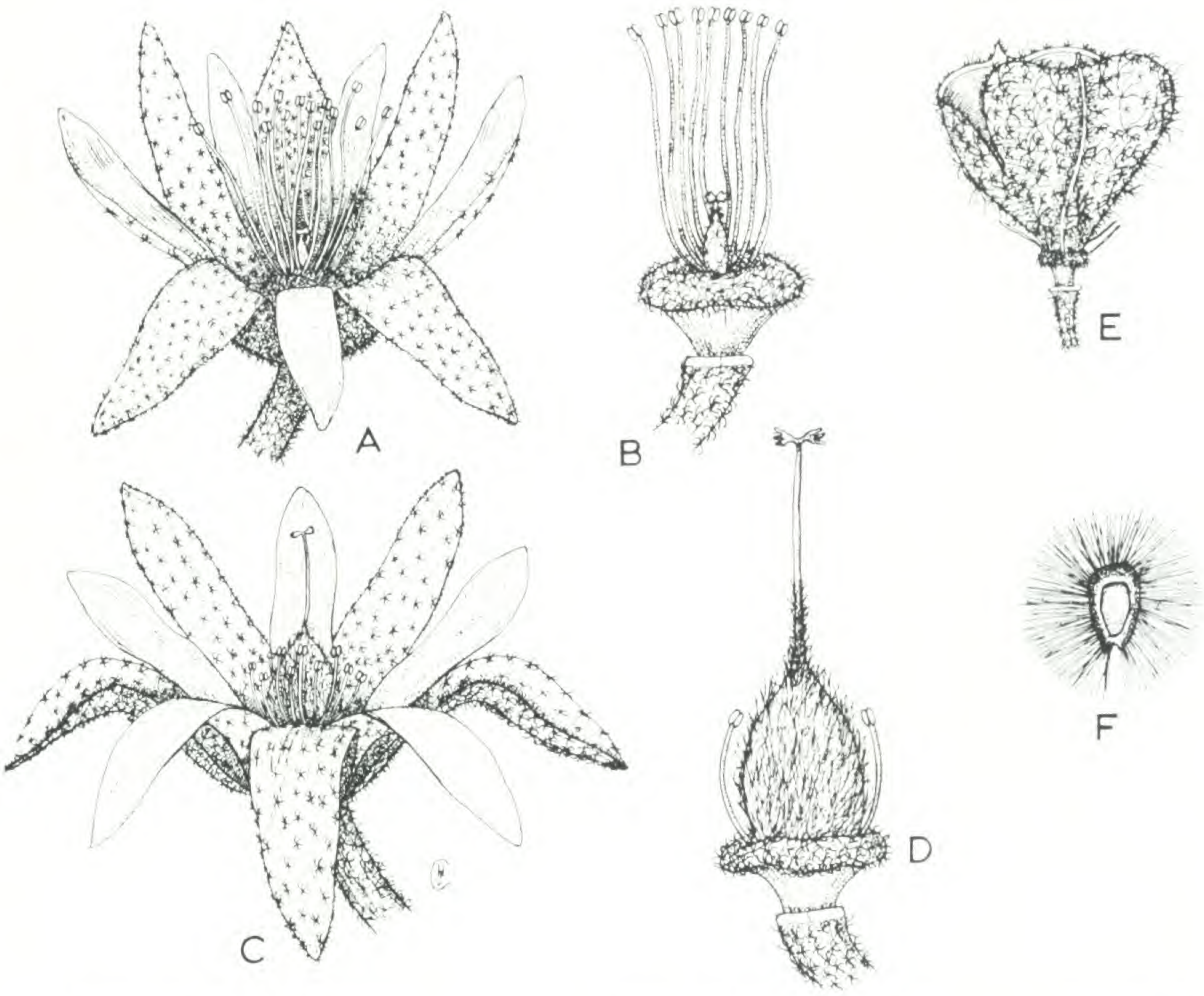

Figure 2. TRICHOSPERMUM MEXICANUM (DC.) Baill.: A, male flower (× 3); B, id., calyx, corolla and some stamens removed (× 5); C, female flower (× 3); D, gynoecium and 2 sterile stamens (× 5); E, capsule (× 1); F, seed (× 2½).

unequal, 5-9 mm. long and hirtellous near the base in the male flowers, much shorter and ca. 1.5-3 mm. in the female ones; anthers suborbicular, ca. 0.5 mm. long in the male flowers and ca. 0.2-0.3 mm. in the female ones; ovary of the male flowers very small, ovoid, ca. 1-1.5 mm. long and 0.75 mm. broad, more or less glabrous to villous at the base, the style obsolete, the stigma obscurely bilobulate and papillate; ovary of the female flowers pyriform, ca. 2.5-3 mm. long and 2.2-5 mm. broad, densely long-sericeous, the style filiform, 2.5-4 mm. long, puberulous near the base, the stigma bilobulate, the lobes spreading and densely laciniate. *Capsule* depressed-obovate, truncate or sometimes somewhat cordate and apiculate at the apex, 10-18 mm. long and 17-22 mm. wide, densely provided with 2 tiers of stellate hairs; seeds broadly ellipsoid, ca. 2.5 mm. in diam., long-ciliate along the margins, the hairs simple and ca. 2.5-3 mm. long.

From southern Mexico through Central America to Panama, Colombia and northern Ecuador, along the Pacific coast, chiefly in cutover forests.

CANAL ZONE: Gatun, *Ostenfeld 82;* Barro Colorado Island, *Brown 54, 111, Ebinger 301, Harvey 5208, Shattuck 422, Wetmore & Abbe 57, Wilson 94, Woodworth & Vestal 344, 736;* Las Cascadas Plantation, near Summit, *Standley 25795, 29573;* Valley of Masambi, on the road to Las Cascadas Plantation, alt. 20-100 m., *Pittier 2584;* Summit, *Lindsay 295;* Paraiso Station, *Hayes 438;* near junction K-6 road near Cocoli, *Dwyer 5020;* along an old trail above the Reservoir, 1 to 3 miles from Gorgona, alt. 40-150 m., *Maxon 4736.* CHIRIQUÍ: vicinity of Remedios, 0-150 m., *Allen 3662.* COCLÉ: El Valle de Antón, North Hills, *Allen 3543.* DARIEN: vicinity of Yaviza, along Río Chucunaque, El Punteadero, bridge on Inter-American Hwy., short distance from Yaviza, *Stern, Chambers, Dwyer, Ebinger 146;* Caná and vicinity, 2,000-6,500 ft. ele., *R. S. Williams 772.* PANAMA: Cerro Campana, *Allen 2092;* Arraijan, *P. & G. White 64;* along road between Balboa and Chame, *Dodge, Hunter, Steyermark & Allen 16738;* near Panama, *Sargent 21;* Pacora, *Killip 3311;* vicinity of Pacora, alt. ca. 35 m., *Allen 1009;* locality unknown, *Allen 1127.* SAN BLAS: Permé, *Cooper 655.*

3. GOETHALSIA Pittier

GOETHALSIA Pittier, Repert. Sp. Nov. **13:** 313. 1926.

Trees, tall, the trunk often buttressed, the pubescence generally of stellate hairs. *Leaves* alternate, short-petiolate, stipulate, the stipules small and deciduous, the blade serrate, 3-palminerved. *Inflorescences* of axillary or terminal, loose cymes. *Flowers* hermaphrodite, actinomorphous, pedicellate, calyculate, the bractlets 3, valvate, fleshy, caducous; calyx valvate, the sepals 5, free, fleshy; petals 5, free, imbricate, about half the length of the sepals, glandular-thickened within at the base; gonophore short, naked, crowned by a short, membranous urceolus surrounding the base of the stamens; stamens ca. 25, the filaments free, unequal; anthers 2-thecate, medifixus, longitudinally dehiscent; ovary superior, sessile, 3- or 4-celled, the cells 4-ovulate; style simple, filiform; stigma obscurely parted. *Fruit* composed of 3(-4) samaras separating at maturity from a central axis, each samara 1- to 4-seeded; seeds pyriform, flattened; albumen copious; embryo straight; cotyledons flat, foliaceous.

A neotropical, monotypic genus. Gleason (Phytologia **1:** 112. 1934) and Baehni (Candollea **6:** 44-45. 1935) have excluded the genus *Goethalsia* from the *Tiliaceae*, assigning it either to the *Flacourtiaceae* or to the *Bixaceae* sensu lato. These authors have based their interpretation chiefly on the placentation of the ovary which they erroneously interpreted as parietal! Weibel (Candollea **10:** 170. 1945) however, in studying the placentation of the *Tiliaceae*, decided to retain this genus in the family on the grounds that the ovary, while divided into 3 or 4 cells, still has incomplete fusion of the margins of the carpels.

1. GOETHALSIA MEIANTHA (J. D. Sm.) Burret, Notizbl. Bot. Gart. Mus. Berlin **9:** 815. 1926.—Fig. 3.

Luehea meiantha J. D. Sm., Bot. Gaz. **24:** 394. 1897.
Goethalsia isthmica Pittier, Repert. Sp. Nov. **13:** 314. 1914.

Tree 15-45 m. high, the trunk 0.35-1.5 m. in diam., often strongly buttressed, the young branchlets minutely puberulous. *Leaves* with a terete petiole 0.8-1.8 cm.

long, shortly tomentellous, the blade elliptic to oblong-elliptic, acute to rounded at the base, acuminate at the apex, 6.5-18 cm. long and 2.5-7 cm. wide, chartaceous, discolor, the margins remotely serrate, the upper surface green and sparsely puberulous, the lower surface pale, densely and minutely appressed-puberulous, the nervation prominent beneath. *Inflorescences* axillary or terminal, the cymes usually few-flowered, the axes shortly tomentellous. *Flowers* pale yellow, the pedicel ca. 8-9 mm. long, the bractlets ovate to broadly ovate, acute or obtuse at the apex, slightly unequal, ca. 6-6.5 mm. long and 3.5-4 mm. wide, shortly tomentellous without, densely and minutely villous within; sepals narrowly lanceolate, acuminate, ca. 13-14 mm. long and 2-2.5 mm. wide, densely and shortly arachnoid outside, long-arachnoid especially on the upper half inside; petals oblong to narrowly obovate, unguiculate and gibbose at the base, obtuse at the apex, 5-6 mm. long and 1.2-2 mm. wide, the claw cuneate, ca. 1.5-2 mm. long, entirely glandular-thickened within, densely villous above the claw, elsewhere papillate and with scattered long stellate hairs; gonophore ca. 1.5-1.8 mm. long, the urceolus ca. 2 mm. in diam., densely villous

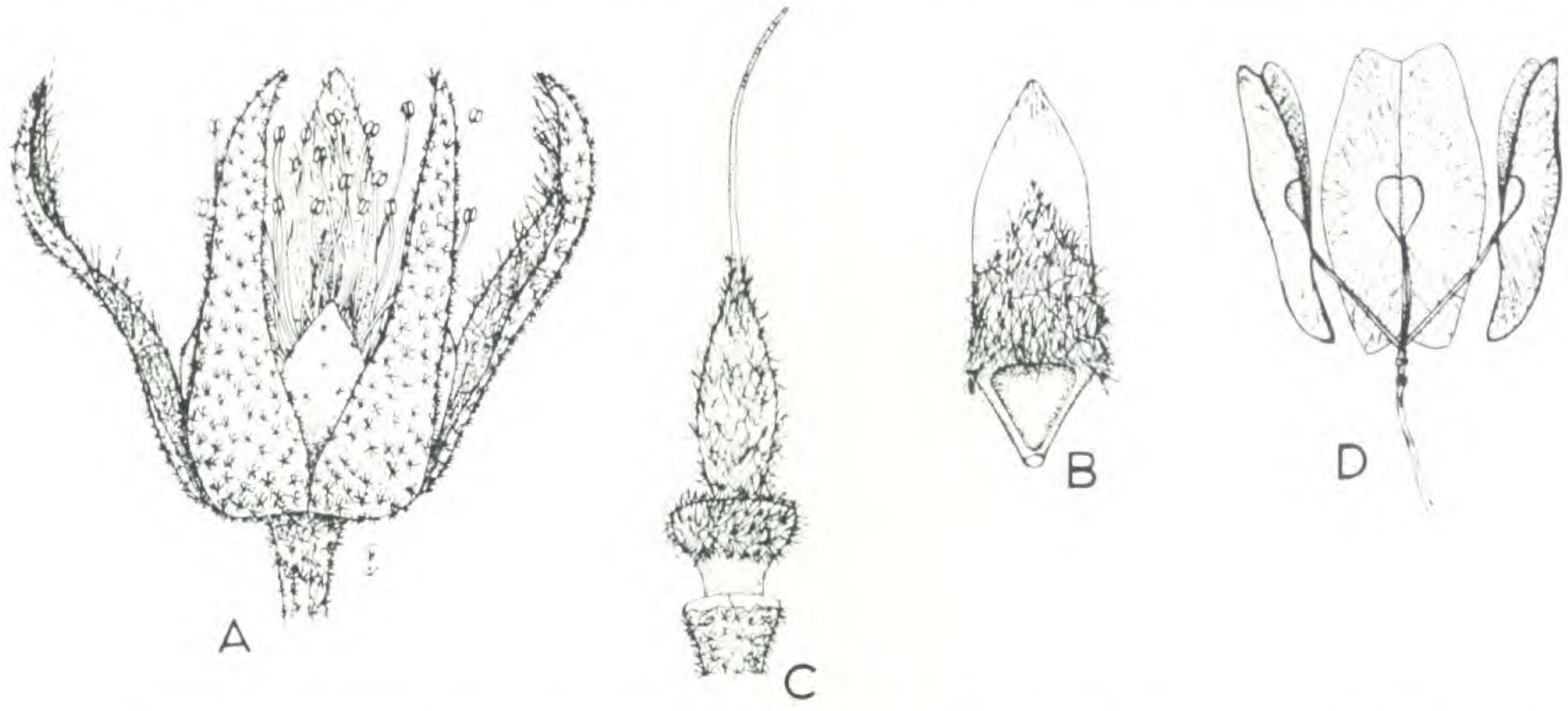

Figure 3. GOETHALSIA MEIANTHA (J. D. Sm.) Burret: A, flower (× 3); B, petal from inside (× 5); C, gonophore, urceolus and gynoecium (× 5); D, samaras separating from the central axis (× ½).

except the base; stamens ca. 22-25, the filaments 5-7 mm. long and glabrous, the anthers ca. 0.5 mm. long; ovary ellipsoid, slightly 3-angled, ca. 2.5-3 mm. long and 1.5 mm. broad, densely appressed-villous; style ca. 3-5 mm. long, glabrous or slightly villous at the base; stigma obscurely 3-lobulate. *Samaras* broadly winged, the wings emarginate at both ends, 4-4.5 cm. long and ca. 2.2 cm. wide, puberulous to tomentellous on the outer surface; seeds ca. 2.8-4 mm. long and 1.8-2.5 mm. broad.

Costa Rica, Panama and Colombia (Boyaca); according to Allen (The rain forest of Golfo Dulce 210. 1956), *G. meiantha* is one of the most common and characteristic trees in the Golfo Dulce region in Costa Rica, where it occurs in old clearings and on the margins of the forests and occasionally in pastures; in Colombia (Gleason, Phytologia **1**:112. 1934), it has been collected at 900 m. altitude in the western mountains of Boyaca.

CHIRIQUÍ: forest around Puerto Remedios, alt. 0-150 m., *Pittier 5445* (type), *Allen 3662;* Progresso, *Cooper & Slater 219.*

4. CORCHORUS L.

Corchorus L., Sp. Pl. 529. 1753, Gen. Pl. ed. 5, 234. 1754.

Antichorus L., Syst. Nat. ed. 12, **2**: 264. 1767, Mant. Pl. 9. 1767.
Caricteria Scop., Intr. Hist. Nat. 104. 1777.
Maerlensia Vell., Fl. Flum. 231. 1825.
Ganja Reichenb., Handb. Nat. Pflanzens. 303. 1837.

Herbs, undershrubs or shrubs, the pubescence of simple or stellate hairs. *Leaves* alternate, petiolate, 2-stipulate, the stipules small and bristle-like, the blade serrate, palminerved. *Flowers* small, oppositifolious or axillary, solitary or geminate or 3-nate, hermaphrodite, actinomorphous, pedicellate, bracteolate; calyx valvate, the sepals 4-5, free, deciduous; petals 4-5, free, generally imbricate, glandless; stamens numerous or rarely twice the number of the sepals, the filaments inserted on a short torus, free or more or less long-connate; anthers 2-thecate, introrse, medifixus, versatile, longitudinally dehiscent; ovary superior, sessile, 2- to 5-celled (1-celled in bud), each cell many-ovulate; style simple; stigma densely papillate. *Capsules* chartaceous to coriaceous, elongated, silique-like and smooth, or short, subglobose and muricate, loculicidally 2- to 5-valvate, sometimes internally transversely septate; seeds numerous, small, pendulous or horizontal, albuminous; embryo generally curved; cotyledons cordate, foliaceous.

A genus of about 30 species distributed throughout the tropics. Two asiatic species, *C. olitorius* L. and *C. capsularis* L., are cultivated in many tropical countries for the important fibre, jute. Only three species occur in Panama and one or two others grow in Central America.

a. Ovary and capsule 2-celled.
  b. Leaves hirsute on both sides; sepals long-hirsute without, glabrous within; capsule caudate-acuminate at the apex, ca. 3 cm. long, more or less densely long-hirsute; herb .... 1. C. hirtus
  bb. Leaves glabrous or nearly so on both sides; sepals glabrous; capsule acute with 4 minute teeth at the apex, 3.8-6 cm. long, inconspicuous puberulous; small shrub .... 2. C. siliquosus
aa. Ovary 3-celled; capsule 3-celled, long-caudate-acuminate at the apex, 3-6 cm. long, glabrous or nearly so .... 3. C. orinocensis

1. Corchorus hirtus L., Sp. Pl. ed. 2, 747. 1762.—Fig. 4 (A-B).

Corchorus pilosus H. B. K., Nov. Gen. Sp. Pl. **5**: 338. 1823, *t.487* (1822).
Maerlensia hirsuta Vell., Fl. Flum. 231. 1825, Fl. Flum.Ic. **5**: *t.112*. 1835.
Corchorus villosissimus St.-Hil., Juss. & Camb., Fl. Bras. Merid. **1**: 217. 1827.
Corchorus humilis St.-Hil., Juss. & Camb., loc. cit. 218. 1827.
Corchorus hirtus var. *pilosus* K. Schum. in Mart., Fl. Bras. **12**(3): 127. 1886.
Corchorus hirtus var. *brasiliensis* K. Schum. in Mart., loc. cit. 127. 1886.
Corchorus hirtus var. *villosissimus* (St-Hil., Juss. & Camb.) K. Schum. f. *humilis* (St.-Hil., Juss & Camb.) K. Schum. in Mart., loc. cit. 128. 1886.
Corchorus hirtus var. *villosissimus* f. *adscendens* K. Schum. in Mart., loc. cit. 128. 1886.
Corchorus hirtus var. *villosissimus* f. *Hilarianus* K. Schum. in Mart., loc. cit. 128. 1886.
Corchorus hirtus var. *Martii* K. Schum. in Mart., loc. cit. 128. 1886.

Herb, usually erect or sometimes spreading, the stem attaining 40-60 cm. or even more in height, sometimes somewhat woody below, branched or not, sparsely to densely hirsute, the hairs usually simple. *Leaves* short-petiolate, the petiole 3-5

mm. long, densely hirsute, the stipules linear-lanceolate, curved, acuminate, longer than the petioles, ca. 5-7 mm. long, hirsute; blade lanceolate to oblong-lanceolate or more or less ovate, acute at the apex, 1.5-4.3 cm. long and 0.7-2 cm. wide, herbaceous, the margins serrate-crenate, hirsute on both sides, 3-palminerved. *Flowers* oppositifolious (or sometimes axillary?), solitary or sometimes geminate,

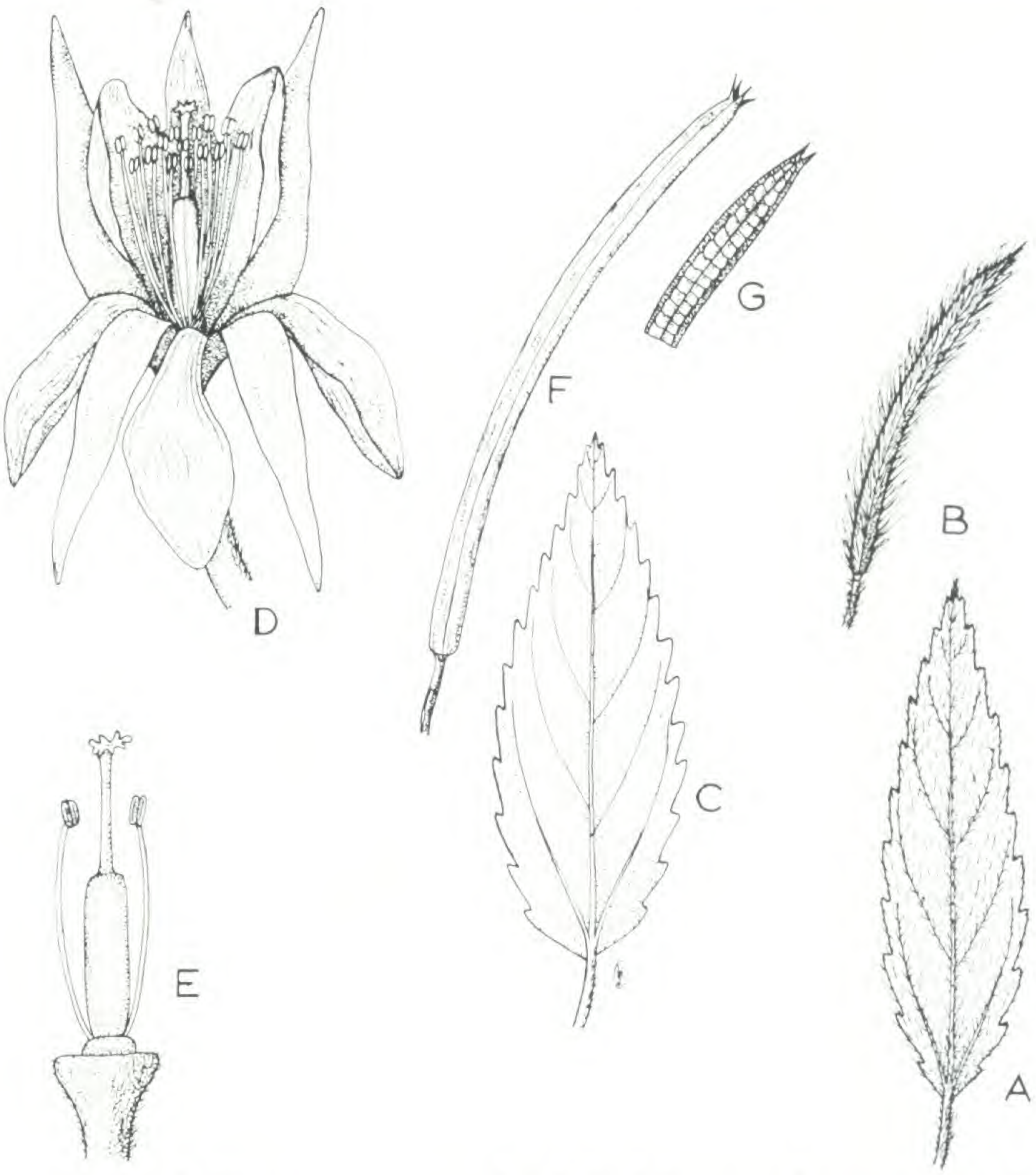

Figure 4. CORCHORUS HIRTUS L.: A, leaf, lower surface (× 1½); B, capsule (× 1). CORCHORUS SILIQUOSUS L.: C, leaf, lower surface (× 1½); D, flower (× 4); E, gynoecium and 2 stamens (× 5); F, capsule (× 1); G, longitudinal section of the upper part of the capsule (× 1).

the pedicel longer than the petiole, ca. 4-10 mm. long, densely long-hirsute; sepals 5, linear, long-acuminate, 7.5-10 mm. long and 1-1.2 mm. wide, long-hirsute without, glabrous within; petals 5, spatulate, rounded, 7.5-9 mm. long and 2.5-3.5 mm. wide, yellow, glabrous; stamens numerous, the filaments free to more or less long-connate, ca. 7 mm. long, the anthers more or less reniform, ca. 0.5 mm. long; ovary narrowly oblong, compressed, ca. 2-2.5 mm. long and 0.5 mm. in diam., densely long-sericeous, 2-celled; style filiform, ca. 4 mm. long, glabrous; stigma peltate, subbilobulate, the lobes densely papillate. *Capsule* erect, linear, compressed contrary to the partition, caudate-acuminate at the apex, ca. 3 cm. long and 0.25 cm. in diam., 2-celled, the valves chartaceous and more or less densely long-hirsute; seeds numerous, polygonal, ca. 1 mm. long, the testa black.

A weedy species found throughout tropical America.

CANAL ZONE: Sosa Hill, Balboa, *Standley 26445*. HERRERA: Ocú, *Ebinger 1087*. PANAMA: hills between Capira and Potrero, 80-130 m., *Dodge & Hunter 8635;* sabanas north of Panama City, *Bro. Paul 532;* Tocumen, *Dwyer 2102*.

2. CORCHORUS SILIQUOSUS L., Sp. Pl. 529. 1753; Johnston, Sargentia **8:** 192. 1949.—Fig. 4 (C-G).

Corchorus orinocensis sensu Standley, Contr. Arnold Arb. **5:** 100. 1933.

Shrub usually 1 m. or less high, sometimes to 2 m. in height, the branchlets terete, smooth, glabrous except one of two longitudinally short-puberulous rows. *Leaves* petiolate, the petiole 0.5-2.8 cm. long, short-puberulous above, glabrous beneath, the stipules narrowly lanceolate, acuminate, ca. 2.5 mm. long, glabrous; blade ovate to more or less elliptic, rounded and somewhat cordate at the base, acute at the apex, 2-7 cm. long and 0.9-3.5 cm. wide, membranous, discolored, the margins crenate-serrate, glabrous or nearly so on both sides, usually 3-palminerved. *Flowers* oppositifolious or axillary, solitary, geminate or 3-nate, short-pedicellate, the pedicel terete, enlarged at the apex, 4-8 mm. long, inconspicuous-puberulous; sepals 5, narrowly oblong-lanceolate, long-acuminate, 7-8 mm. long and 1-1.5 mm. wide, fleshy, glabrous; petals 5, obovate, rounded, 5-6 mm. long and 3 mm. wide, yellow, glabrous; stamens numerous, free, the filaments ca. 4-5 mm. long, the anthers oblong, ca. 0.5 mm. long; ovary narrowly oblong, ca. 3 mm. long and 0.75 mm. in diam., very shortly puberulous, 2-celled; style filiform, ca. 2.5 mm. long, glabrous; stigma subbilobate, densely papillate. *Capsule* erect, linear, compressed contrary to the partition, acute and with 4 minute teeth at the apex, 3.8-6 cm. long and 2-2.5 mm. in diam., 2-celled, the valves coriaceous-chartaceous, inconspicuously puberulous; seeds numerous, polygonal, ca. 1 mm. long.

A common, weedy shrub distributed throughout the American tropics and north to southern Florida.

BOCAS DEL TORO: Isla Colón, vicinity of Chiriquí Lagoon, *von Wedel 2855*. CANAL ZONE: vicinity of Fort Sherman, *Standley 31137;* Gatun, *Bro. Heriberto 125;* hills west of the Canal, near Gatun, *Standley 27254;* Barro Colorado Island, *Aviles 12;* Gamboa, *Standley 28425;* between Summit and Gamboa, *J.M. & M.T. Greenman 5245;* Las Cascadas Plantation, near Summit, *Standley 25814;* vicinity of Summit, *Standley 30139;* around Culebra, alt. 50-150 m., *Pittier 4779;* Río Paraiso, above East Paraiso, *Standley 29903;* along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29210;* Camino de Corozal, *Bro. Heriberto 253;* Ancon, *Bro. Celestine 6, Macbride & Featherstone 12;* Balboa, *Standley 27156;* Sosa Hill, Balboa, *Standley 26474;* Colón to Empire, *Crawford 430;* around Tabernilla, along the railroad, alt. 20-25 m., *Pittier 3817*. COCLÉ: between Las Margaritas and El Valle, *Woodson, Allen & Seibert 1238*. COLÓN: vicinity of Gatuncillo, *Piper 5629;* locality unknown, *Kuntze s.n.* PANAMA: Río Potrero, ca. 2 mi. from Arraijan, *Duke 4679;* along the Corozal Road, near Panama, *Standley 26774;* Bella Vista, *Killip 12006;* Nuevo San Francisco, *Standley 30719;* near Matias Hernández, *Standley 28938;* between Matias Hernández and Juan Díaz, *Standley 32052;* Río Tapía, *Standley 26208, 28274;* Taboga Island, *Miller 1958, Standley 27988;* San José Island, *Erlanson 196*. PROVINCE UNKNOWN: *Seemann s.n.*

3. CORCHORUS ORINOCENSIS H. B. K., Nov. Gen. Sp. Pl. **5:** 337. 1823.

Corchorus hirtus L. var. *orinocensis* (H. B. K.) K. Schum. in Mart., Fl. Bras. **12**(3): 127. 1886.

Herb, erect, bushy, sometimes somewhat woody below, 0.30-1.2 m. high, the hairs usually simple, the stems glabrous except a row of hirsute-arachnoid hairs decurrent from the base of the petioles. *Leaves* rather long-petiolate, the petiole 0.7-1.6 cm. long, hirsute-arachnoid above and glabrous or nearly so beneath, the stipules subulate, shorter than the petioles, ca. 4-5 mm. long, ciliate; blade lanceolate to narrowly lanceolate, rounded at the base, acute to long-acuminate at the apex, 3-8 cm. long and 0.9-2.5 cm. wide, membranous, the margins irregularly serrate and ciliolate, glabrous or nearly so on both sides except along the hirtellous nerves, 5-palminerved, the nervation slightly prominent beneath. *Flowers* oppositifolious, generally geminate, the pedicel shorter than the petiole, ca. 3-5 mm. long, hirsute-arachnoid; sepals 5, narrowly linear, long-acuminate, 7.5-9.5 mm. long and 1-1.5 mm. wide, very loosely hirsute to hirtellous without, glabrous within; petals 5, spatulate, rounded, 5.5-8 mm. long and 2-3 mm. wide, yellow, glabrous; stamens numerous, the filaments free to more or less long-connate, ca. 5-7 mm. long, the anthers somewhat arcuate, ca. 0.6-0.7 mm. long; ovary narrowly oblong, more or less 3-angled, ca. 1.7-2 mm. long and 0.7-0.8 mm. in diam., shortly sericeous or rarely glabrescent, 3-celled; style more or less 3-angled, ca. 1.5-2.5(-4) mm. long, glabrous; stigma peltate, shortly papillate. *Capsule* erect, linear, cylindrical, slightly 3-sulcate, long-caudate-acuminate at the apex, 3-6 cm. long and ca. 2 mm. in diam., 3-celled, the valves chartaceous and glabrous or nearly so at maturity; seeds numerous, polygonal, ca. 1.5 mm. long, the testa black.

Southern United States (Florida to Texas and Arizona), Central America, West Indies and tropical South America; chiefly in moist thickets and in weedy fields.

CANAL ZONE: Summit, *Standley 26907;* vicinity of Summit, *Standley 30130;* around Culebra, alt. 50-150 m., *Pittier 4775;* along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29088;* Balboa, *Standley 25534, 26069;* Sosa Hill, Balboa, *Standley 25230;* vicinity of Balboa, *Bro. Celestine 7.* PANAMA: along the Corozal Road, near Panama, *Standley 26768;* Camino de Las Sabanas, *Bro. Heriberto 200;* La Exposición, *Bro. Heriberto 242;* Bella Vista, *Standley 25329;* vicinity of Juan Franco Race Track, near Panama, *Standley 27686;* between Matias Hernández and Juan Díaz, *Standley 32050;* near Matias Hernández, *Standley 28969;* Agricultural Experiment Station at Matias Hernández, *Pittier 6811;* Pearl Islands, Trapeche Island, *Miller 1872.*

5. MORTONIODENDRON Standley & Steyerm.

MORTONIODENDRON Standley & Steyerm., Field Mus. Nat. Hist., Bot. Ser. **17:** 411. 1938.

Orthandra Burret, Notizbl. Bot. Gart. Mus. Berlin **15:** 13. 1940.

Shrubs or small to tall trees, the trunk sometimes buttressed, the hairs usually stellate, sometimes simple. *Leaves* alternate, petiolate, stipulate, the stipules very small and caducous, the blade entire, asymmetrical at the base, penninerved. *Inflorescences* terminal or axillary, cymose-paniculiform, the bracts very small.

Flowers hermaphrodite, actinomorphous, pedicellate, (3-)4- or 5-merous; calyx valvate, the sepals (3-)4-5, free, thick, fleshy, pubescent without, glabrous within; petals 4-5 or absent, free, valvate, somewhat shorter than the sepals; stamens numerous, all fertile, grouped into 4-5 phalanges opposite the petals, the filaments of each phalanx shortly connate at the base; anthers oblong, mucronate at the apex, 2-thecate, introrse, basifixus, erect, longitudinally dehiscent; ovary superior, sessile, (3-)4- or 5-celled, the cells many-ovulate (4-5 ovules in each cell?); style simple; stigma undivided. *Capsules* loculicidally dehiscent, (3-)4- or 5-loculate, each cell 1- to 3-seeded; seeds pendulous, arillate, the aril fleshy; albumen copious, carnose; cotyledons flat, foliaceous.

A genus of seven species confined to tropical Central America. Certain species are still imperfectly known, only the flowers being described or only the fruits, and some species may perhaps be reduced later to synonymy. Two species (one only known in fruit) occur in Panama. A single collection, lacking flowers, may represent however a third species.

a. Tall tree; hairs stellate; branches minutely puberulous; blade of the leaves elliptic to oblong-elliptic, subcoriaceous; capsule ca. 4 cm. long and broad .... 1. M. anisophyllum

aa. Shrub; hairs mostly simple; young branches long-hirsute; blade of the leaves narrowly oblong, membranous; capsule ca. 2 cm. long and 2.5 cm. broad .... 2. M. hirsutum

1. Mortoniodendron anisophyllum (Standley) Standley & Steyerm., Field Mus. Nat. Hist., Bot. Ser. **17**: 411, *fig.* 26-27. 1938.—Fig. 5 (A-G).

Sloanea anisophylla Standley, Field Mus. Nat. Hist., Bot. Ser. **4**: 228. 1929.
Orthandra anisophylla (Standley) Burret, Notizbl. Bot. Gart. Mus. Berlin **15**: 13. 1940.

Tree 12-30 m. high, the trunk 45 cm. or even more in diam., often strongly buttressed, the crown spreading, the pubescence of stellate hairs, the branches shortly puberulous. *Leaves* with a petiole 8-12 mm. long, shortly tomentellous, the blade elliptic to oblong-elliptic, obtuse to rounded and asymmetric at the base, acuminate at the apex, 8-15 cm. long and 3.8-7.5 cm. wide, subcoriaceous, glabrous or nearly so above, very sparsely and shortly puberulous especially along the nerves beneath. *Inflorescences* terminal, of loose, paniculiform cymes, the axes shortly tomentellous. *Flowers* cream-white, the pedicel 5-13 mm. long; sepals 5, ovate to elliptic, acute 9-10 mm. long and 3.5-5 mm. wide, shortly tomentellous without, glabrous within; petals 5, elliptic, ca. 7 mm. long and 3 mm. wide; stamens glabrous, ca. 50, grouped into 5 phalanges of 10 stamens each, the filaments unequal, equalling or shorter than the anthers, shortly connate at the base for ca. 1 mm., the anthers unequal, 1.5-2 mm. long; ovary pyriform, ca. 3 mm. long and wide, shortly tomentellous; style ca. 3 mm. long, shortly tomentellous at the base. *Capsule* ligneous, more or less globulose, ca. 4 cm. long and broad, shortly tomentellous, 5-celled, each cell 2- to 3-seeded; seeds pyriform, ca. 10 mm. long and 6 mm. broad.

Native to Costa Rica and Panama.

bocas del toro: region of Almirante, *Cooper* 352 (type).

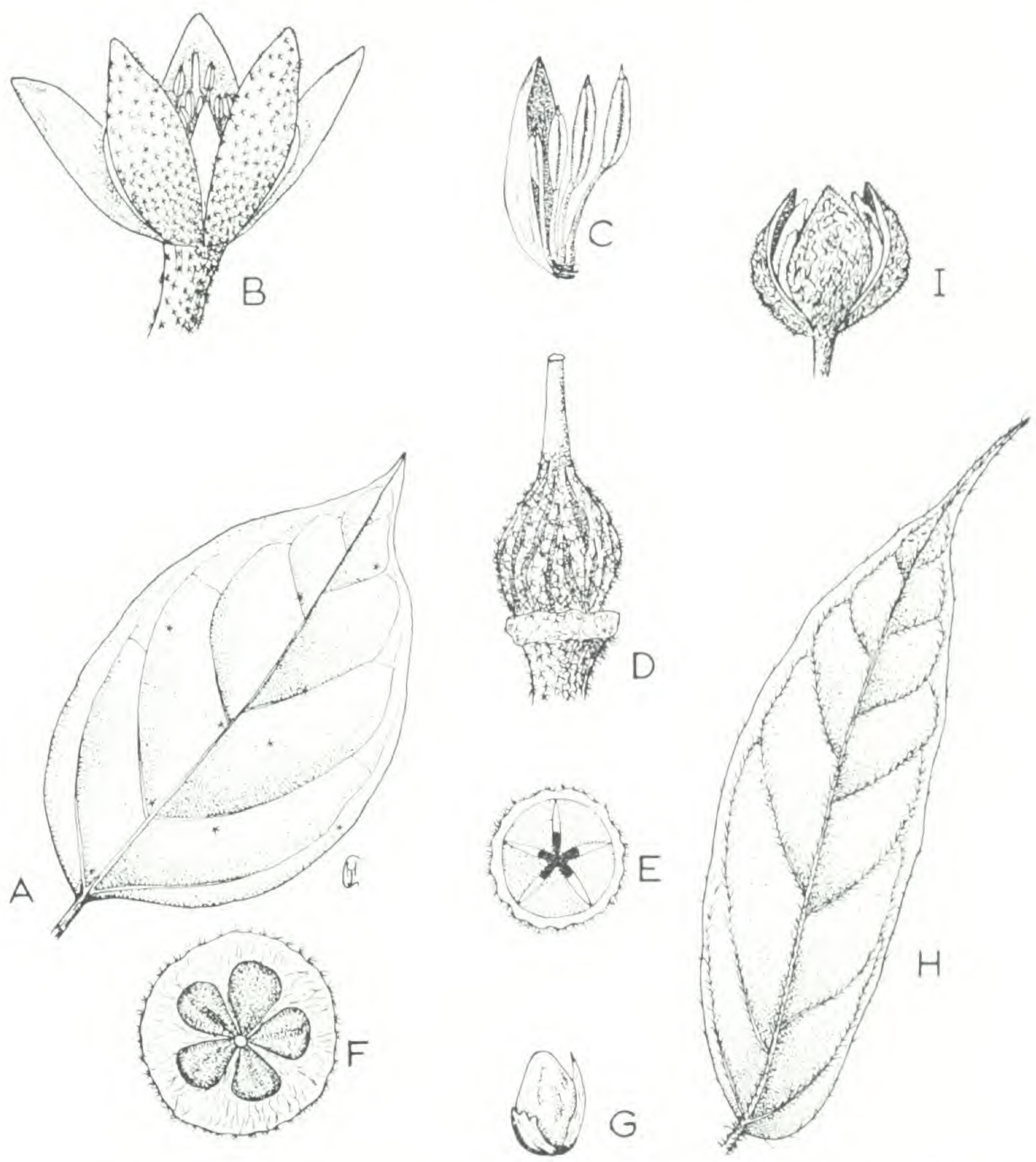

Figure 5. MORTONIODENDRON ANISOPHYLLUM (Standley) Standley & Steyerm.: A, leaf, lower surface (× ½); B, flower (× 2); C, petal and 4 stamens (× 3); D, ovary (× 4); E, cross-section of ovary (× 4); F, cross-section of capsule (× ½); G, seed (× 1). MORTONIODENDRON HIRSUTUM Standley: H, leaf, lower surface (× ½); I, capsule (× 1).

2. MORTONIODENDRON HIRSUTUM Standley, Ann. Missouri Bot. Gard. **29:** 359. 1942. —Fig. 5 (H-I).

Shrub 1 m. high, the hairs mostly simple, the young branches long-hirsute. *Leaves* shortly petiolate, the petiole thick, 4-5 mm. long, densely long-hirsute, the blade narrowly oblong, much asymmetric at the base, acute on one side of the midrib and rounded to subcordate on the other side, very long-acuminate at the apex, 10.5-17 cm. long and 3-4.5 cm. wide, membranous, sparsely long-hirsute along the nerves on both surfaces, 3-nerved at the base, the nervation prominent beneath. *Inflorescences* terminal, few-flowered, the axes long-hirsute, the fructiferous pedicels ca. 12 mm. long. *Flowers* unknown. *Capsule* depressed-globose, ca. 2 cm. long and 2.5 cm. broad, shortly yellowish-tomentellous, the valves thick and ca. 12 mm. wide, 5-celled, each cell 2-seeded; seeds obtuse-angled, ca. 6 mm. in diam.

Native to Panama. This species is very closely related to the Honduran *M. membranaceum* Standley & Steyerm. (Field Mus. Nat. Hist., Bot. Ser. **22**: 158. 1948). It differs chiefly by the long hirsute pubescence of the young branches, of the leaves and of the inflorescence-axes. Lacking flowers of *M. hirsutum* and capsules of *M. membranaceum*, it is impossible to establish the relationship of the two species!

BOCAS DEL TORO: Water Valley, vicinity of Chiriquí Lagoon, *von Wedel 1694* (type).

3. Mortoniodendron sp.

Tree 30 m. high, the hairs stellate, the young branches puberulous. *Leaves* with a petiole 8-10 mm. long, nearly glabrous above and tomentellous beneath, the blade ovate to elliptic, much asymmetric at the base, acute on one side of the midrib and rounded to subcordate on the other side, acute to obtuse at the apex, 6-10 cm. long and 3.5-4.5 cm. wide, subcoriaceous, glabrous or nearly so above, tomentellous at the base of the midrib to scatteringly puberulous elsewhere beneath, 3-nerved at the base, the nervation prominent beneath. *Inflorescences* terminal, few-flowered, the axes tomentellous, the fructiferous pedicels ca. 9 mm. long. *Flowers* unknown. *Capsule* more or less globose, apiculate, ca. 14 mm. in diam., shortly tomentellous, 5-celled; seeds ca. 5 mm. long and 4 mm. broad.

This species is related to the Guatemalan species, *M. guatemalense* Standley & Steyerm. (Field Mus. Nat. Hist., Bot. Ser. **22**: 157. 1948), but differs in the shape and the texture of the leaves and by the 5-celled capsule. In *M. guatemalense*, the membranous leaves are oblong-elliptic or oblong-lanceolate and long-acuminate, and the ovary is 3-(cf. Miranda, Anal. Inst. Biol. Univ. Mex. **27**: 331, *fig.* 3 *(B)*. 1956) or 4-celled (observation on type material, *Hatch & Wilson 54*). Study of additional material is necessary in order to evaluate these differences.

COCLÉ: region north of El Valle de Antón, alt. 1,000 m., *Allen 3728*.

6. APEIBA Aubl.

Apeiba Aubl., Hist. Pl. Gui. Fr. 537. 1775.

Aubletia Schreb. in L., Gen. Pl. ed.8, 353. 1789.
Oxytandrum Neck., Elem. Bot. **2**: 255. 1790.

Trees or tall shrubs, the pubescence of stellate hairs or fimbrillate lepidotes. *Leaves* alternate, petiolate, the stipules rapidly or tardily deciduous, the blade with entire or serrulate margins, 3- to 5(-7)-palminerved. *Inflorescences* oppositifolious or terminal, paniculate. *Flowers* hermaphrodite, actinomorphous, pedicellate, bracteolate; calyx valvate, the sepals 4-5, free or sometimes very slightly connate at the base, deciduous; petals 4-5, free, imbricate, glandless; stamens numerous, free or usually connate into a short staminal tube, the filaments short; anthers 2-thecate, introrse, basifixus, erect, longitudinally dehiscent, with a sterile membranous appendage of the connective at the top; ovary superior, sessile, (8-)10- to many-celled, the cells many-ovulate; style simple; stigma minutely denticulate. *Capsules*

ligneous, transversely elliptic, densely to coarsely bristly or spinose, opening at the top by woody teeth or by a nearly circular hole; seeds numerous, small, embedded in a lustrous pulp, the testa thin-coriaceous; albumen carnose; embryo straight; cotyledons orbicular-cordate.

A neotropical genus of seven species of which two occur in Central America and in Panama.

a. Leaves more or less rugose and sparsely stellate-puberulous above, densely stellate-arachnoid beneath; appendage of the anthers ca. 1 mm. long; capsule transversely elliptic, ca. 4 cm. long and 7-8 cm. broad, covered with long flexible and stout hirsute bristles .... 1. A. TIBOURBOU

aa. Leaves scatteringly and minutely stellate-puberulous to glabrate above, densely and very minutely fimbrillate-lepidote and generally with tufts of brownish hairs in the axils of the secondary nerves beneath; appendage of the anthers ca. 4-4.5 mm. long; capsule transversely narrow-elliptic, ca. 1.5 cm. long and 5.5-6.5 cm. broad, covered with short to rather long, stout, conic-based, minutely puberulous to glabrate spines .... 2. A. MEMBRANACEA

1. APEIBA TIBOURBOU Aubl., Hist. Pl. Gui. Fr. 538, *t.213*. 1775; Johnston, Sargentia **8:** 192. 1949.

Apeiba hirsuta Lam., Encycl. Méth. Bot. 1: 203. 1783.
Apeiba cimbalaria Arruda, Diss. Pl. Brazil 46. 1810.
Apeiba tibourbou var. *rugosa* Szyszyl., Diss. Math.-Phys. Acad. Crac. **27:** 140. 1894.

Tree 6-30 m. high, the trunk 20-35 cm. or even more in diam., sometimes with small buttresses, the crown spreading, the branchlets densely hirsute. *Leaves* with a petiole 1.3-3 cm. long, densely long-hispid, the stipules triangular, acuminate at the apex, the margins entire or serrate, 2-3 cm. long and ca. 1 cm. wide at the base, densely sericeous without, glabrous within except the sericeous base, rather tardily deciduous; blade ovate, elliptic to oblong-elliptic, sometimes slightly obovate, cordate at the base, acute to long-apiculate at the apex, 10-33 cm. long and 5.5-15 cm. wide, firm-chartaceous, the margins serrulate, more or less rugose and rather sparsely stellate-puberulous above, densely stellate-arachnoid beneath, 5(-7)-palminerved, the nervation prominent beneath. *Inflorescences* oppositifolious, the axes covered with 2 kinds of hairs, a lower tier densely and shortly stellate-puberulous and an upper tier more or less sparsely long-hirsute, the bracts stipuliform, densely sericeous without, glabrous or nearly so within. *Flowers* with a pedicel 0.8-1.7 cm. long, the sepals 4-5, lanceolate to oblong-lanceolate, cucullate and acute, 1.5-2.2 cm. long and 0.5-0.4 cm. wide, fleshy, covered with 2 kinds of hairs, a lower tier densely and shortly stellate-puberulous and an upper tier sparsely long-sericeous, glabrous within; petals 4-5, spatulate to more or less obovate, rounded and somewhat emarginate, 1.1-1.6 cm. long and 0.5-0.8 cm. wide, yellow, glabrous; stamens free to slightly connate, the filaments 3.5-4.5 mm. long, sparsely long-pilose especially above, the anthers linear, ca. 3-3.5 mm. long, sparsely long-pilose especially at the base and along the margins, the appendage often bifid and ca. 1 mm. long; ovary more or less globose, somewhat depressed at both ends, ca. 3 mm. long and 4.5 mm. broad, densely and shortly hirsute, many-celled; style 0.8-1.2 cm. long, glabrous; stigma shortly denticulate.

Capsule transversely elliptic, somewhat concave at the apex, ca. 4 cm. long and 7-8 cm. broad, very densely covered with long, flexible and stout bristles, these up to 1.5 cm. long and hirsute; seeds more or less globose, somewhat flattened, ca. 2.5 mm. in diam.

Throughout tropical Central and South America, in dry forests and thickets or in open sunlight, at edge of savannas and along roads. Colloquial names reported in Panama are *peine de mico* (monkey-comb), *cortezo* and *cortez*.

CANAL ZONE: Chagres, Isthmus of Panama, *Fendler 326;* near Fort Randolph, *Maxon & Harvey 6528a;* Gatun, *Hayes 106, 193, 220, 1034;* lake shore along Gatun River Valley, *Pittier 6743;* Barro Colorado Island, *Bangham 376, 390, Ebinger 262, Kenoyer 431, Killip 40011, Salvoza 850, Shattuck 287, Starry 143, Wetmore & Abbe 44, 124, Woodworth & Vestal 352, 504, 694, Zetek 5084;* Mamei Hill, alt. 20-90 m., *Pittier 3799;* around Gamboa, alt. 20-100 m., *Pittier 4801;* Cerro Gordo, near Culebra, *Standley 25960;* Pedro Miguel, *Piper 5515;* Cerro Luisa, above Pedro Miguel Locks, *Stern & Chambers 7;* between Miraflores and Pedro Miguel, *P. & G. White 48;* C2 east of Fort Clayton, *Harvey 5105;* vicinity of Río Cocoli, Road K-9, *Stern, Chambers, Dwyer, Ebinger 323, 331;* Balboa, *Standley 29290;* about 2 miles west of Balboa, *Correll 12254;* Balboa Heights, *J.M. & M.T. Greenman 5058;* western slope of Ancon Hill, vic. of Balboa. 20-75 m., *Seibert 391;* Ancon Hill, *Bro. Gervais 311, Bro. Heriberto 132, Killip 12111, Maxon 6776;* sabanas along drowned Río Azote Caballo, 66-70 m., *Dodge, Steyermark & Allen 16849;* locality unknown, *Johansen 8.* CHIRIQUÍ: Progresso, *Cooper & Slater 163.* COCLÉ: Penonomé and vicinity, *R.S. Williams 320.* DARIEN: vicinity of El Real, ca. 15 m., *Allen 960;* trail between Caná and Boca de Cupe, vicinity of El Real, along road to Río Pirre, *Stern, Chambers, Dwyer, Ebinger 601;* vicinity of Campamento Buena Vista, Río Chucunaque above confluence with Río Tuquesa, *Stern, Chambers, Dwyer, Ebinger 860.* PANAMA: near Arraijan, ca. 15 m., *Woodson, Allen & Seibert 1362;* Panama, *Seemann 316;* Sabanas, *Bro. Paul 71;* Bella Vista, *Macbride 2745;* east of Bella Vista, *Maxon & Valentine 6936;* near Matias Hernández, *Standley 28950;* near the big swamp east of the Río Tocumen, *Standley 26547;* along road between Panama and Chepo, *Dodge, Hunter, Steyermark & Allen 16631;* Chepo, *Kluge 57;* 5-6 mi. e. of Chepo on Pan-Am. Highway, *Duke 4051;* Taboga Island, *Killip 3200;* Pedro Gonzalez Island, *Allen 2601;* San José Island, *Erlanson 99, 247, 289, Harlow 64, Johnston 8.* SAN BLAS: Permé, *Cooper 236;* locality unknown, *Cooper 277.* VERAGUAS: vicinity Santa Fe - Río Santa Maria, 1,000 ft., *Allen 4415.*

2. Apeiba membranacea Spruce ex Benth., Jour. Proc. Linn. Soc., Bot. **5** (Suppl. 2): 61. 1861.—Fig. 6.

Apeiba aspera Aubl., Hist. Pl. Gui. Fr. 545, *t.216.* 1775; Standley, Contr. U. S. Nat. Herb. **27**: 47. 1928

Tree 20-30 m. tall, the trunk attaining 75 cm. in diam., the branchlets shortly stellate-puberulous. *Leaves* with a petiole slightly enlarged at the apex, 1-3.3 cm. long, shortly stellate-puberulous on the lower part to shortly stellate-tomentellous on the upper part, the stipules rapidly deciduous; blade oblong-elliptic to oblong-obovate, rounded to subcordate at the base, acuminate at the apex, 7-26 cm. long and 3-9.5 cm. wide, rigid-chartaceous, the margins entire to slightly subserrulate, scatteringly and very shortly stellate-puberulous to glabrate above, densely and very shortly fimbrillate-lepidote and generally with tufts of brownish hairs in the axils of the secondary nerves beneath, 3-palminerved, the nervation prominent especially beneath. *Inflorescences* oppositifolious, the panicles loose and few-flowered, the axes shortly stellate-tomentellous, the bracts missing at

anthesis. *Flowers* with a pedicel 1-1.2 cm. long, the sepals 5, narrowly lanceolate, very slightly connate at the base, cucullate and acute at the apex, 1.8-2.6 cm. long and 0.3-0.5 cm. wide, fleshy, shortly stellate-tomentellous to stellate-puberulous outside, sometimes mixed with scattered, long hairs, glabrous within; petals 5, spatulate to obovate-spatulate, rounded and more or less deeply

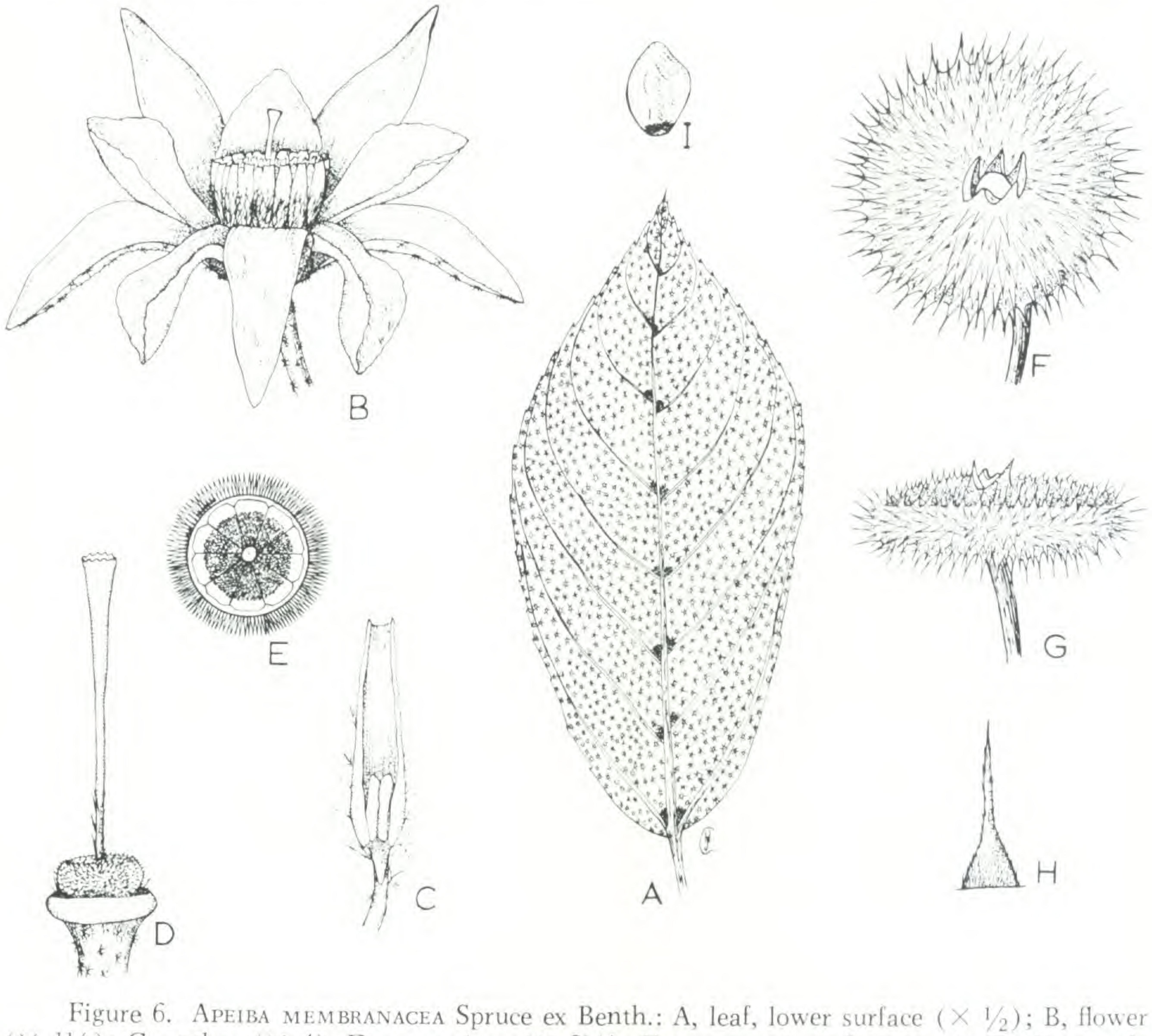

Figure 6. APEIBA MEMBRANACEA Spruce ex Benth.: A, leaf, lower surface (× ½); B, flower (× 1½); C, anther (× 4); D, gynoecium (× 2½); E, cross-section of ovary (× 5); F, capsule from above (× ½); G, capsule, lateral view (× ½); H, spine of capsule (× 2½); I, seed (× 2½).

emarginate, 1.35-2 cm. long and 0.65-1.3 cm. wide, yellow, glabrous; stamens connate into a very short tube ca. 1.5-2 mm. long, the filaments ca. 1.5 mm. long, long-pilose, the anthers ca. 2 mm. long, sparsely pilose especially at the base and along the margins, the appendage retuse and ca. 4-4.5 mm. long; ovary transversely elliptic, ca. 1.5 mm. long and 3.5 mm. broad, densely scabrous-hispidulous, many-celled; style ca. 1.2 cm. long, sparsely hispidulous at the base; stigma shortly denticulate. *Capsule* transversely narrow-elliptic, sometimes apiculate, ca. 1.5 cm. long and 5.5-6.5 cm. broad, densely covered with short to rather long, stout, conic-based spines, these shortly puberulous to glabrate; seeds ca. 3.5-4 mm. long and 2.5-3 mm. broad.

Costa Rica and Panama, western South America from Colombia to northern Bolivia; forested hills.

In the past, all the collections of Panama were referred to *A. aspera* Aubl., a name considered by Uittien (Rec. Trav. Bot. Néerl. **22:** 360. 1925) as *nomen confusum*, Aublet (Hist. Pl. Gui. Fr. 545, *t. 216.* 1775) confusing here two species, *A. echinata* Gaertn. and *A. glabra* Aubl. The taxonomy of some species of this group is still unsatisfactory in spite of the revision made by Uittien (loc. cit. **32:** 244-251, *fig. 4.* 1935). In distinguishing species in his revision, he uses as essential basis the shape of the capsule and the nature of the pubescence of the leaves, the latter character well known to be extremely variable in the *Malvales*. In the absence of an exhaustive study of all available herbarium material, I am obliged to use the conclusions of Uittien, suggesting nevertheless that *A. membranacea* and the very closely related species, *A. echinata* Gaertn. emend. Uitt. (Guianas, north-easthern Brazil), are doubtfully specifically distinct and form perhaps only the extreme variation within a single taxon.

BOCAS DEL TORO: Water Valley, *von Wedel 810.* CANAL ZONE: Barro Colorado Island, *Shattuck 1157, Standley 31367, Wetmore & Abbe 115;* drowned forest of upper Río Pequeni between Salamanca Hydrographic Station and Río Boqueron, 70 m., *Allen 17286.* COCLÉ: region north of El Valle de Antón, alt. 1,000 m., *Allen 3746.* COLÓN: between France Field, Canal Zone and Catival, *Standley 30303;* Zona de la Gloria, near Fato (Nombre de Dios), alt. 10-104 m., *Pittier 4087;* Guarunta, Wispernini Camp, 50-75 ft., *C. & W. von Hagen 1395.* DARIEN: Río Chico, vicinity Yaviza, 100 ft., *Allen 4578;* on trail between Paya and Pucra, Río Paya, *Stern, Chambers, Dwyer, Ebinger 215;* Caná and vicinity, *R. S. Williams 947.* PANAMA: vicinity of Arenoso, lower Río Trinidad, 26-50 m., *Seibert 627.* PROVINCE UNKNOWN: *Hayes s.n.*

7. HELIOCARPUS L.

Heliocarpus L., Sp. Pl. 448. 1753, Gen. Pl. ed. 5, 205. 1754.

Adenodiscus Turcz., Bull. Soc. Imp. Nat. Moscou **19**(2): 504. 1846.

Shrubs or trees, the pubescence of stellate hairs, the young branches usually pubescent, the older ones glabrate or nearly so. *Leaves* alternate, petiolate, stipulate, the stipules usually large, fugacious or infrequently persistent, the blade entire or 3-lobate, sometimes auriculate-appendaged at the base, the margins irregularly serrate, the basal serrations usually glandular, 3- to 7-palminerved. *Inflorescences* gynodioecious or hermaphrodite, usually terminal, infrequently axillary, large, paniculiform, the ultimate branchlets bearing clustered cymes. *Flowers* either hermaphrodite or pistillate, actinomorphous, pedicellate, 4- to 5-merous; calyx valvate, the sepals sometimes minutely appendiculate at the apex, usually pubescent without, glabrate within; petals 4-5 in the hermaphrodite flowers, absent in the pistillate ones, free, valvate, shorter than the sepals, glandless; stamens 12-40 in the hermaphrodite flowers, staminodial or absent in the pistillate ones, inserted on an enlarged and very short gonophore, the filaments free; anthers 2-thecate, introrse, more or less medifixus, versatile, longitudinally dehiscent; ovary superior, sessile on the gonophore or borne on a gynophore, laterally compressed, ciliate along the margins and with shorter pubescence on the

faces, 2-celled (falsely 4-celled at the base), the cells 2-ovulate; style filiform, bifid, the stigma-lobes spreading, simple or slightly 2- to 3-lobulate. *Fruit* capsular, sessile or stipitate upon the accrescent gynophore, laterally compressed and bearing along the margins 2 rows of long plumose bristles, the faces pubescent or glabrate, indehiscent, 2-loculate, (1-)2(-3)-seeded; seeds small, pendulous, compressed-ovoid or compressed-pyriform; albumen carnose; embryo straight; cotyledons plane, foliaceous.

A neotropical genus of ten species of which only one occurs in Panama.

1. Heliocarpus popayanensis H. B. K., Nov. Gen. Sp. Pl. **5:** 341. 1823; Lay, Ann. Missouri Bot. Gard. **36:** 532, *fig. 10.* 1949.—Fig. 7.

Heliocarpus trichopodus Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 226. 1858.
Heliocarpus americanus L. var. β *popayanensis* (H. B. K.) K. Schum. in Mart., Fl. Bras. **12**(3): 142. 1886.
Heliocarpus polyandrus S. Wats. var. *nodiflorus* J. D. Sm., Bot. Gaz. **23:** 240. 1897.
Heliocarpus nodiflorus (J. D. Sm.) J. D. Sm. & Rose, Contr. U. S. Nat. Herb. **5:** 126. 1897.
Heliocarpus americanus var. *Schumanni* E. G. Baker, Jour. Bot. **36:** 131. 1898.
Heliocarpus popayanensis var. *Purdiei* E. G. Baker, loc. cit. 132. 1898.
Heliocarpus popayanensis var. *trichopoda* (Turcz.) E. G. Baker, loc. cit. 132. 1898.
Heliocarpus popayanensis var. *grandifolius* Hochr., Ann. Conserv. Jard. Bot. Genève **18:** 116. 1914.
Heliocarpus diclinus Hochr., loc. cit. 117. 1914.
Heliocarpus boliviensis Hochr., loc. cit. 118. 1914.
Heliocarpus Rosei Hochr., loc. cit. 119. 1914.
Heliocarpus stipulatus Hochr., loc. cit. 121. 1914.
Heliocarpus australis E. E. Wats., Bull. Torr. Bot. Club **50:** 124. 1923.
Heliocarpus rudis E. E. Wats., loc. cit. 126. 1923.
Heliocarpus subtrilobus Sprague, Bot. Mag. **61:** 257. 1923.
Heliocarpus excelsior Morton, Jour. Wash. Acad. Sci. **27:** 307. 1937.
Heliocarpus Gentlei Lundell, Phytologia **2:** 3. 1941.

Tree 6-30 m. tall, the young branches ferruginous-tomentellous to puberulous, the older ones glabrate. *Leaves* with a petiole 6-8 cm. long, ferruginous-puberulous, the blade broadly ovate to ovate-cordate, rounded to deeply cordate at the base, usually with 3 acuminate lobes, sometimes obscurely 3-lobed or only acuminate at the apex, 16-20 cm. long and 14-18 cm. wide, discolored, the margins irregularly serrulate, the upper surface dark green, sparsely and shortly ferruginous-puberulous, the lower surface light green and ferruginous-puberulous, 5- to 7-palminerved, the nervation very slightly prominent beneath. *Inflorescences* gynodioecious, usually terminal, the cymes ca. 12- to 20-flowered, sometimes condensed in nodose clusters, the flowering peduncles 3-radiate. *Hermaphrodite flower* with a pedicel ca. 2-4 mm. long, tomentellous, the sepals 4, narrowly lanceolate, acute and somewhat cucullate, ca. 4-7 mm. long and 1-1.2 mm. wide, fleshy, tomentellous without, glabrous within; petals 4, narrowly spatulate, ca. 3-4.5 mm. long and 0.5-0.75 mm. wide, glabrous; stamens about 12-24, the filaments ca. 3-4 mm. long, the anthers ca. 0.75 mm. long; ovary borne on a very short gynophore ca. 0.5 mm. long, ovoid to suborbicular, ca. 0.6-0.8 mm. long and 0.5-0.7 mm. broad; style ca. 1-2 mm. long, bifid about one third of its length, the stigma-lobes usually obscurely 2- to 3-lobulate. *Pistillate flower* with a pedicel ca. 2 mm. long, tomentellous, the

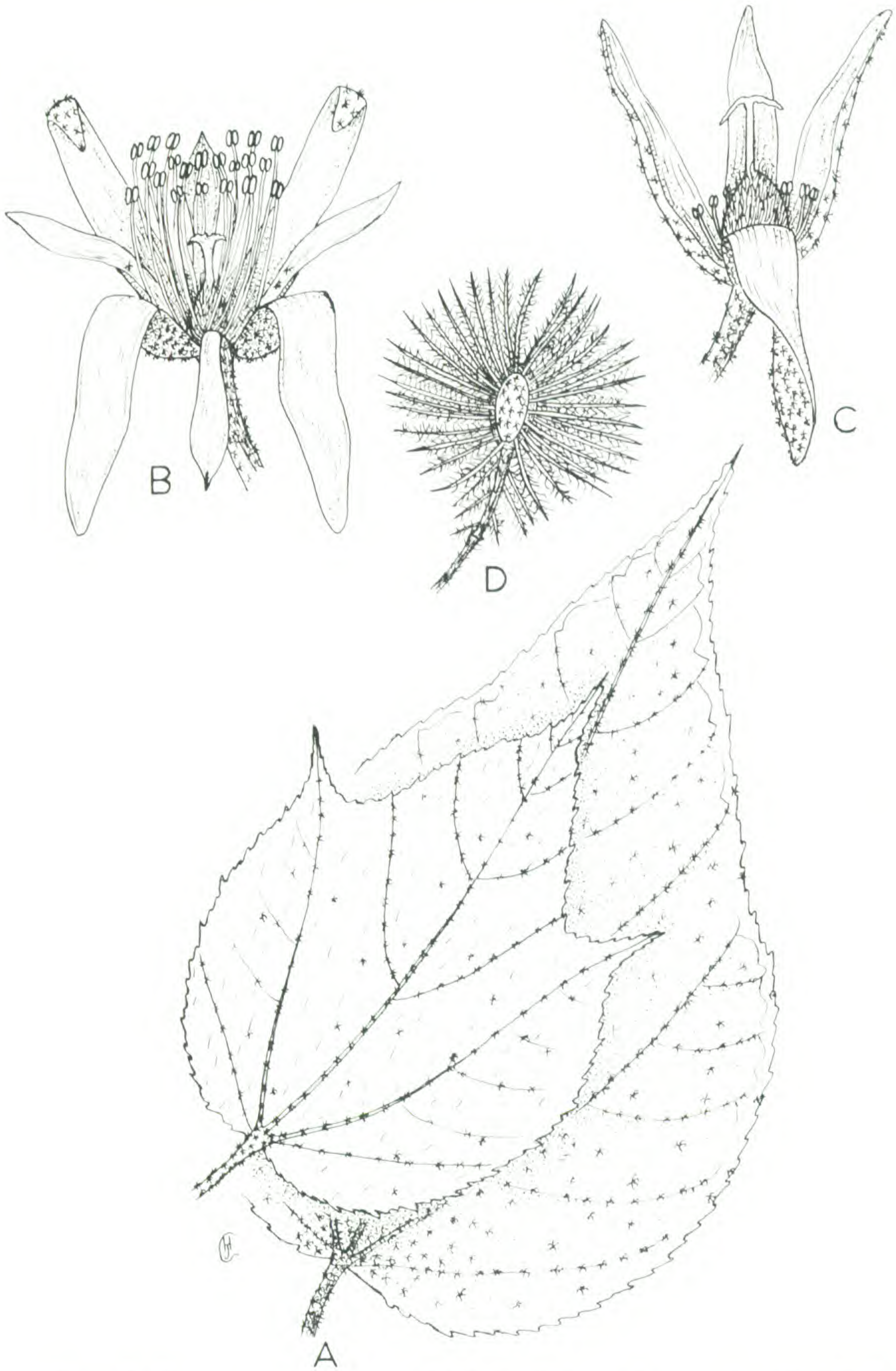

Figure 7. Heliocarpus popayanensis H. B. K.: A, leaves, lower surface (× ⅔); B, hermaphrodite flower (× 6⅔); C, pistillate flower (× 6⅔); D, fruit (× 2⅔).

sepals 4, narrowly lanceolate, acute and somewhat cucullate, ca. 4-5.5 mm. long and 1-1.5 mm. wide, fleshy, tomentellous without, glabrous within; petals reduced or absent; staminodes numerous; ovary borne on a very short gynophore ca. 0.5 mm. long, more or less suborbicular, ca. 1-1.2 mm. in diam.; style ca. 1.3-1.8 mm. long, slightly bifid to bifid about one third of its length, the stigma lobes obscurely lobulate. *Fruit* ellipsoid to slightly obovoid, the accrescent gynophore ca. 5-10 mm. long, shortly stellate-hirsute and provided with some plumose bristles, the body ca. 3-4 mm. long and 2-3 mm. broad, the plumose bristles ca. 4-7 mm. long, the faces covered either with stellate hairs or with shorter plumose bristles and stellate hairs; seeds ovoid, ca. 2.5 mm. long, with a depression in the middle.

A species which extends from southern Mexico to northern Argentina and grows usually at altitudes from 500-2,500 m., in secondary forested valleys or on slopes; the local name is *majagüillo*.

CANAL ZONE: Gatun, *Ostenfeld 50*; Barro Colorado Island, *L.H. & E.Z. Bailey 380, Frost 218, Shattuck 662, 754, Wetmore, Abbe & Aviles 108, Woodworth & Vestal 730, 748;* Darien Station, *Standley 31552;* Empire Station, *Hayes 437;* Empire to Mandinga, *Piper 5532;* Cerro Gordo, near Culebra, alt. 50-290 m., *Pittier 2305;* C 16, back of Curundu, *Harvey 5288;* along an old trail above the Reservoir, 1 to 3 miles from Gorgona, alt. 40-150 m., *Maxon 4751;* locality unknown, *Christopherson 117.* CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, *P. White 29;* vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, *Allen 1398;* vicinity of Cerro Punta, alt. 2,000 m., *Allen 1519;* slopes of Volcán Baru, near town of Cerro Punta, alt. 6,000 ft., *Stern & Chambers 77;* between Cerro Vaca and Hato del Loro, alt. 850-1,100 m., *Pittier 5392;* around Camp Aguacatal, eastern slope of Chiriquí Volcano, alt. 2,100-2,200 m., *Pittier 3082.* COCLÉ: hills south of El Valle de Antón, alt. 600-800 m., *Allen 2849;* south rim of El Valle de Antón, alt. 650 m., *Allen 2912;* El Valle de Antón, along Río Indio trail, 500-700 m., *Hunter & Allen 304.* COLÓN: vicinity of Gatuncillo, *Piper 5612.* DARIEN: Caná and vicinity, *R. S. Williams 827;* locality unknown, *Macbride 2713.* PROVINCE UNKNOWN: *Cowell 270, 271, Hayes 947, 1015.*

8. TRIUMFETTA L.

TRIUMFETTA L., Sp. Pl. 444. 1753, Gen. Pl. ed. 5, 203. 1754.

Bartramia L., Sp. Pl. 389. 1753, Gen. Pl. ed.5, 184. 1754.
Porpa Blume, Bijdr. Fl. Nederl. Ind. 117. 1825.
Ceratosepalum Oliv., Hook. Ic. Pl. *t.2307.* 1894.

Shrubs or trees, the pubescence usually of stellate hairs. *Leaves* alternate, petiolate, stipulate, the stipules usually large and persistent, rarely fugacious, the blade entire or 3- to 5-lobed or rarely 5- to 7-partite, the margins irregularly serrate, the basal serrations usually glandular, 3- to 7-palminerved. *Inflorescences* hermaphrodite or gynodioecious, usually axillary, sometimes terminal, consisting generally of numerous aggregate dichasia, the bracts foliaceous. *Flowers* either hermaphrodite or pistillate, actinomorphous, pedicellate, generally 5-merous, rarely 4- or 6-merous; sepals valvate, with apical appendages, usually pubescent without, glabrous within; petals sometimes absent, free, imbricate, shorter than the sepals, usually ciliate at the base, glandless; gonophore short, sometimes obsolete, bearing 5 manifest glands opposite the petals, these sometimes united into a

full ring or sometimes absent, usually crowned by a ciliate membranous urceolus surrounding the stamens; stamens 5-60 in the hermaphrodite flowers, staminodial or absent in the pistillate ones, the filaments free; anthers 2-thecate, introse, more or less medifixus, longitudinally dehiscent; ovary superior, sessile on the gonophore, infrequently borne on a very short gynophore, ellipsoid to orbicular, covered with many, short, straight to uncinate, hyaline spinules, 2- to 5-loculate, the cells 2-ovulate; style filiform; stigma entire or shortly 2- to 5-parted. *Fruit* capsular, mostly sessile on the slightly accrescent gonophore, covered with many tubercles, bristles or spines elongating from the pericarp at the base of the spinules, the appendages glabrous or pilosulose and topped by the hyaline, straight to uncinate spinules, indehiscent or loculicidally dehiscent, 2- to 5-loculate, the cells 2-seeded, or falsely 6- to 10-celled, the cells 1-seeded, exceptionally 1-celled and 1-seeded by abortion; seeds pendulous, compressed-ovoid to pyriform, albuminous; embryo straight; cotyledons flat, foliaceous.

A large pantropical genus of about 150 species of which some are widely distributed as weeds in cultivated fields. In his recent revision of the genus for the New World, Ko Ko Lay (Ann. Missouri Bot. Gard. **37**: 315-395. 1950) recognizes 43 species in tropical America; five species are reported from Panama, but one other, *T. semitriloba* Jacq., is to be expected, while several others occur in Central America north of Panama.

a. Hyaline spinules of ovary and fruit straight or arcuate; petals 5.
  b. Flowers large, 3.4-3.7 cm. long; stamens ca. 20; fruit-body 6-8 mm. in diam. .... 1. T. SPECIOSA
  bb. Flowers small, 8-10 mm. long; stamens ca. 50; fruit-body 3-4 mm. long and ca. 2 mm. in diam .... 2. T. ARBORESCENS
aa. Hyaline spinules of ovary and fruit uncinate.
  c. Petals 5; stamens 20-30; gonophore ca. 0.7-0.8 mm. long, bearing 5 manifest glands, the urceolus ca. 0.5 mm. long.
    d. Flowers 12-18 mm. long; apical appendages of sepals 1-1.5 mm. long; petals 10.5-13 mm. long; fruit covered with very numerous spines (ca. 200), these sparsely hirtellous especially near the base ... 3. T. GRANDIFLORA
    dd. Flowers 8-13 mm. long; apical appendages of sepals 1.8-2.5 mm. long; petals 7-9 mm. long; fruit covered with ca. 75 retrorsely pilosulose spines .... 4. T. BOGOTENSIS
  cc. Petals absent; stamens (5-)10(-15); gonophore and urceolus obsolete, glands absent; fruit covered with about 50 retrorsely pilosulose spines .... 5. T. LAPPULA

1. TRIUMFETTA SPECIOSA Seem., Bot. Voy. Herald 86. 1853; Lay, Ann. Missouri Bot. Gard. **37**: 338. 1950.—Fig. 8.

Triumfetta macrocalyx Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 230. 1858.
Triumfetta micropetala Hochr., Ann. Conserv. Jard. Bot. Genève **18**: 98. 1914.

Shrub 0.60-2 m. high, sometimes small tree up to 3-6 m. tall, the branches and inflorescence-axes rather densely ferruginous-arachnoid. *Leaves* with a petiole 1-5 cm. long or even more, very densely arachnoid, the blade rounded-ovate, often 3-lobate, rounded to more or less cordate at the base, the terminal lobe acuminate, the laterals short and generally rather obtuse, sometimes acuminate, 6-9 cm. long

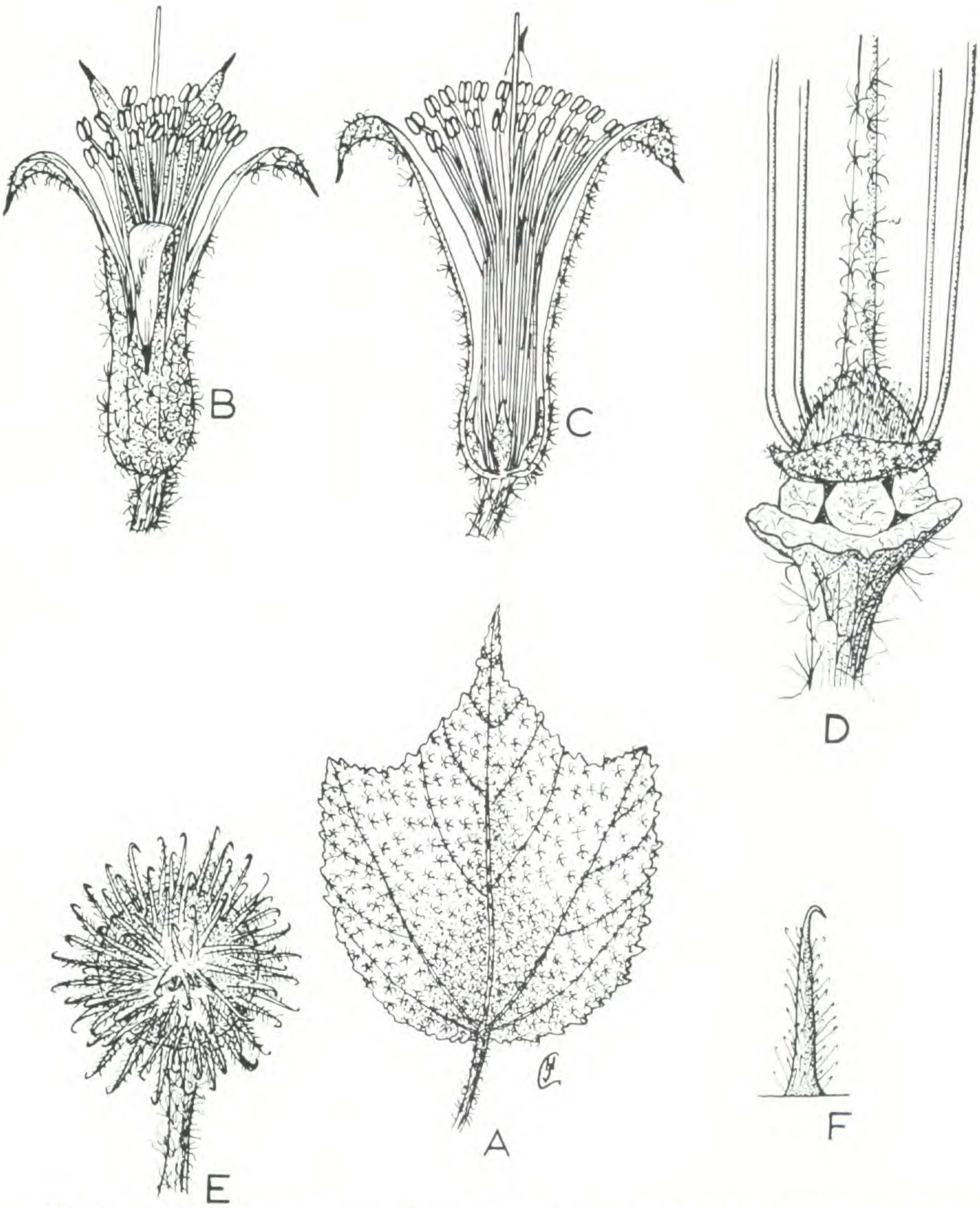

Figure 8. TRIUMFETTA SPECIOSA Seem.: A, leaf, lower surface (× ⅔); B, flower (× 1⅓); C, id., longitudinal section (× 1⅓); D, gonophore, urceolus, ovary, base of style and of 4 filaments (× 6⅔); E, fruit (× 2⅔); F, spine of fruit (× 6⅔).

and 5-7 cm. wide, the margins very irregularly and bluntly serrate, the serrations often glandular, discolor, the upper surface dark green, lightly scabrous-puberulous, the lower surface pale green, densely arachnoid, 3- to 5- to 7-palminerved, the nervation not prominent. *Inflorescences* axillary, the cymes of 1-2 cymules, usually opposite the bracts, these ovate and short-petiolate, the peduncles 4-10 mm. long, the pedicels 4-8 mm. long, both densely arachnoid. *Flowers* large, 3.4-3.7 cm. long, hermaphrodite, the sepals 5, linear-lanceolate, acuminate, the appendages ca. 2-3 mm. long, 3.4-3.7 cm. long and ca. 3.5 mm. wide, long-hirsute without, glabrous within; petals 5, narrowly lanceolate, acute, only 6-7 mm. long and ca.

1.5 mm. wide, very densely hirsute at the base outside, glabrous inside except a transverse densely hirsute band near the base; gonophore ca. 1 mm. long, the 5 glands usually forming a full ring subequalling the gonophore, the urceolus ca. 0.7 mm. long, slightly undulate and densely stellate-ciliolate; stamens ca. 20, the filaments 2.7-3 cm. long, glabrous, the anthers ca. 1.5 mm. long; ovary broadly transversely elliptic, ca. 1 mm. long and 1.5 mm. broad, covered with numerous, slightly arcuate spinules; style 30-34 mm. long, hirsute at the base, the stigma acute. *Fruit* orbicular on the slightly accrescent gonophore, the body 6-8 mm. in diam., rather densely stellate-puberulous, the spines 100 or more, ca. 3 mm. long, densely hirtellous, the spinules arcuate, 4-celled and each cell 2-seeded when young, at maturity with 6-8 distinct, 1-seeded locules; seeds ovoid, ca. 2 mm. long.

Throughout Central America, from southern Mexico to Panama; open areas on slopes of mountains or along the rocky banks of streams at altitudes of 1,300-1,700 m.

CHIRIQUÍ: near Hacienda de Boquete, volcano of Chiriquí, *Seemann 1240;* volcan de Chiriquí, Boquete Distr., 7,000 ft., *Davidson 515, 895;* Finca Lerida to Boquete, ca. 1,300-1,700 m., *Woodson, Allen & Seibert 1115;* vicinity of El Boquete, *Maxon 5081, Pittier 2924;* Bajo Lino, Boquete, 3,500 ft., *Bro. Maurice 876.*

2 TRIUMFETTA ARBORESCENS (Seem.) Sprague, Kew Bull. 1923: 351. 1923; Lay, Ann. Missouri Bot. Gard. **37**: 344. 1950.

Heliocarpus arborescens Seem., Bot. Voy. Herald 86. 1853.

Shrub or small tree, up to 5-6 m. high, the branches and inflorescence-axes ferruginous-tomentellous. *Leaves* with a slender petioles 6-9 cm. long, ferruginous-tomentellous, the blade broadly ovate, usually 3-lobate, cordate at the base, the middle lobe long-acuminate, the laterals acute to acuminate, 10-13 cm. long and 7-10 cm. wide, the margins very irregularly serrate, the basal serrations generally glandular, discolor, the upper surface rather densely puberulous, the lower surface tomentose, usually 7-palminerved, the nervation slightly prominent beneath. *Inflorescences* terminal, the cymes of 3-5 cymules condensed in nodose clusters, the peduncles 2-4 mm. long, the pedicels 2-3.5 mm. long, both ferruginous-tomentellous. *Flowers* 8-10 mm. long, hermaphrodite, the sepals 5, obovate-linear, acute, the appendages ca. 1 mm. long, 8-10 mm. long (the appendages included) and ca. 1.5 mm. wide, palid and tomentellous without, yellow-brown and glabrescent within; petals obovate-spatulate, rounded, ca. 2.5 mm. long and 1 mm. wide, puberulous near the base; gonophore ca. 0.6-0.7 mm. long, with 5 distinct elliptic glands subequalling the gonophore, the urceolus ca. 0.4 mm. long and briefly ciliolate; stamens ca. 50-60, the filaments ca. 3-3.5 mm. long, glabrous, the anthers ca. 0.8 mm. long; ovary ovoid, ca. 0.7 mm. in diam., covered with straight spinules; style ca. 3.5-5 mm. long, glabrous; stigma very shortly 2-parted. *Fruit* suborbicular, the body 3-4 mm. long and ca. 2 mm. in diam., glabrescent, the spines ca. 75, 3-4 mm. long, sparsely hirtellous, the spinules straight to slightly arcuate, 2-celled, each cell 1-seeded; seeds pyriform, flattened, ca. 2.5 mm. long.

Costa Rica and Panama.

COCLÉ: Canton of Natá, on the banks of the Río de Santa Maria, *Seemann 96* (type). PROVINCE UNKNOWN: *Cowell 239*.

3. TRIUMFETTA GRANDIFLORA Vahl, Eclog. Am. **2**: 34. 1798; Lay, Ann. Missouri Bot. Gard **37**: 363. 1950.

Triumfetta nemoralis St.-Hil., Juss. & Camb., Fl. Bras. Merid. **1**: 221, *t.56* (*A*). 1827.
Triumfetta longiseta DC., Pl. Rar. Jard. Genève 64. 1829.
Triumfetta longicuspis Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 229. 1858.
Triumfetta cymosa Triana & Planchon var. *glabrescens* Triana & Planchon, Ann. Sci. Nat., Bot., ser. 4, **17**: 354. 1862.
Triumfetta cymosa var. *hirsuta* Triana & Planchon, loc. cit. 354. 1862.
Triumfetta grandiflora var. *brasiliensis* Hochr., Ann. Conserv. Jard. Bot. Genève **18**: 100. 1914.
Triumfetta boyacana Moldenke, Phytologia **1**: 10. 1933.
Triumfetta Schunkei Macbr., Candollea **5**: 381. 1934.

Shrub or small tree, 2-4 m. high, the young branches and inflorescence-axes more or less densely arachnoid, the hairs mostly stellate, the older branches glabrate. *Leaves* with a slender petiole 3-10 cm. long, arachnoid, the blade ovate to broadly ovate, rounded to cuneate at the base, long-acuminate at the apex, ca. 8-15 cm. long and 5-9 cm. wide, the margins irregularly serrate, the serrations often glandular especially near the base, both surfaces rather sparsely pubescent, the hairs mostly stellate, 3- to 7-palminerved, the nervation slightly prominent beneath. *Inflorescences* usually terminal, the cymes of 1-2 cymules, usually opposite the bracts, these narrowly ovate to narrowly elliptic, the peduncles ca. 4-7 mm. long, the pedicels ca. 3-6 mm. long. *Flowers* 12-18 mm. long, hermaphrodite, the sepals 5, narrowly oblong-lanceolate, acute, the appendages ca. 1-1.5 mm. long, 12-18 mm. long (the appendages included) and 1.5-2.5 mm. wide, sparsely hirsute to glabrescent without, glabrous within; petals 5, narrowly obovate-spatulate, rounded and subcrenate, 10.5-13 mm. long and 2.5-3 mm. wide, yellow, glabrous except the ciliate base; gonophore ca. 0.7-0.8 mm. long, with 5 distinct suborbicular glands, the urceolus undulate, ciliate and ca. 0.5 mm. long; stamens 20-30, the filaments 7-11 mm. long, glabrous, the anthers ca. 1 mm. long; ovary suborbicular, ca. 1.6-2 mm. long and 2.1-2.5 mm. broad, densely covered with uncinate spinules; styles 8-11 mm. long, glabrous; stigma obscurely parted. *Fruit* suborbicular, the body ca. 5-6 mm. in diam., glabrescent, the spines very numerous, ca. 200, ca. 4 mm. long, sparsely hirtellous especially near the base, the spinules uncinate, rather easily loculicidally dehiscent, 3- to 5-loculate, each cell 2-seeded; seeds pyriform, ca. 3 mm. long and 2 mm. wide.

Rather widely distributed throughout tropical America, though not abundant at any single locality, usually growing at altitudes of about 600-2,000 m. Only one specimen has been collected in Panama.

COCLÉ: vicinity of El Valle de Antón, alt. ca. 600 m., *Allen 2027 or 2072*.

4. Triumfetta bogotensis DC., Prodr. **1:** 506. 1824; Lay, Ann. Missouri Bot. Gard. **37:** 366. 1950.

Triumfetta pilosa H. B. K., Nov. Gen. Sp. Pl. **5:** 343. 1823, non Roth, Nov. Pl. Sp. 233. 1821.
Triumfetta sepium St.-Hil., Juss. & Camb., Fl. Bras. Merid. **1:** 222. 1827.
Triumfetta dumetorum Schlecht., Linnaea **11:** 377. 1837.
Triumfetta hispida A. Rich., Bot., Pl. Vasc in Ramon de la Sagra, Hist. Phys. Pol. Nat. Cuba 204. 1845.
Triumfetta grossulariaefolia A. Rich., loc. cit. 205. 1845, *t.22.* 1850(?).
Triumfetta Lindeniana Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 229. 1858.
Triumfetta Botteriana Turcz., loc. cit. **32:** 260. 1859.
Triumfetta orizaba Turcz., loc. cit. **32:** 261. 1859.
Triumfetta Josefina Polak., Linnaea **41:** 552. 1877.
Triumfetta vincentina Urb., Symb. Ant. **5:** 414. 1908.
Triumfetta valenciencis Kunth, Repert. Sp. Nov. Beih. **43:** 464. 1927.
Triumfetta panamensis Johnston, Sargentia **8:** 194. 1949.

Shrub 1-2 m. high, sometimes small tree up to 4 m. high, the branches covered with short stellate and long hirsute simple hairs especially when young. *Leaves* with a petiole 2-7 cm. long, covered with short stellate and long hirsute simple hairs, the blade broadly elliptic, usually 3-lobate, sometimes only obscurely so, rounded to subcordate at the base, the apex acuminate, 7-14 cm. long and 5-11 cm. wide, the margins irregularly and more or less bluntly serrate, the upper surface slightly hirsute and mostly with long simple hairs, the lower surface scatteringly puberulous with appressed stellate hairs and some spreading simple hairs, 5-palminerved, the nervation slightly prominent beneath. *Inflorescences* axillary or oppositifolious, the cymes of 2-3 cymules, the bracts lanceolate to narrowly elliptic, 3-10 cm. long and 1-5 cm. wide, the bracteoles narrowly lanceolate, ca. 3 mm. long, long-hirsute, the peduncles 4-7 mm. long, the pedicels 3-4 mm. long, both long-hirsute. *Flowers* 8-13 mm. long, hermaphrodite, the sepals linear, acute, the apical appendage ca. 1.8-2.5 mm. long, 8-13 mm. long (the appendages included) and ca. 1.5 mm. wide, fleshy, long-hirsute without, glabrous within; petals 5, narrowly obovate, ciliate at the base, more or less acute at the apex, 7-9 mm. long and ca. 2 mm. wide, yellow, sometimes orange; gonophore ca. 0.75 mm. long, bearing 5 distinct suborbicular glands subequalling the gonophore, the urceolus undulate, ciliate and ca. 0.5 mm. long; stamens 25-30, the filaments ca. 4-7 mm. long, glabrous, the anthers ca. 1 mm. long; ovary suborbicular, ca. 1 mm. in diam., densely covered with uncinate spinules; style filiform, 6-7 mm. long, glabrous; stigma obscurely 3-lobulate. *Fruit* spheroid on the slightly accrescent gonophore, the body ca. 4 mm. in diam., stellate-hirsute, the spines about 75, ca. 3-4 mm. long, retrorsely pilosulose, the spinules uncinate, 3- or 4-loculate, each cell 2-seeded; seeds lenticular, 2-3 mm. long and ca. 2 mm. wide.

A weedy species widely distributed throughout tropical America, growing in open sunlight, on hill-slopes, usually at altitudes of about 600-2,000 m.

CANAL ZONE: banks of the Chagres River, near sea level, *Maxon 4799;* Gamboa, *Standley 28500, 28511,* Las Cascadas Plantation, near Summit, *Standley 29603;* Empire to Mandinga, *Piper 5452, 5453, 5462;* Río Grande, near Culebra, alt. 50-100 m., *Pittier 2128;* Cerro Gordo, near Culebra, *Standley 26024;* vicinity of Miraflores, *P. & G. White 52;* along the

old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29204;* Balboa, *Standley 25613;* along an old trail above the Reservoir, 1 to 3 miles from Gorgona, alt. 40-150 m., *Maxon 4730;* base of Contractors Hill, *Dwyer 2871.* CHIRIQUÍ: Bajo Mona, mouth of Quebrada Chiquero, along Río Caldera, ca. 1,500-2,000 m., *Woodson, Allen & Seibert 1002;* vicinity of Bajo Mona and Quebrada Chiquero, alt. 1,500 m., *Woodson & Schery 592;* Boquete, alt. 4,000 ft., *Davidson 861;* vicinity of El Boquete, *Bro. Maurice 692.* PANAMA: hills above Campana, alt. 600-800 m., *Allen 1309;* along the Corozal Road, near Panama, *Standley 26789;* Tumba Muerto Road, near Panama, *Standley 29762;* vicinity of Juan Franco Race Track, near Panama, *Standley 27697;* vicinity of Bella Vista, *Piper 5355;* Sabanas, *Bro. Paul 234;* between Las Sabanas and Matias Hernández, *Standley 31838;* Agricultural Experiment Station at Matias Hernández, *Pittier 6914, 6925;* near Matias Hernández, *Standley 28964;* San José Island, *Johnston 1112.* PROVINCE UNKNOWN: *Hayes 325.*

5. TRIUMFETTA LAPPULA L., Sp. Pl. 444. 1753; Lay, Ann. Missouri Bot. Gard. **37**: 378, *fig. 12.* 1950.

Triumfetta heterophylla Lam., Encycl. Méth. Bot. **3**: 420. 1789.
Triumfetta sinuosa Miq., Linnaea **22**: 466. 1849.
Triumfetta Hostmanni Miq., loc. cit. 466. 1849.
Triumfetta Berterii Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 227. 1858.
Triumfetta Salzmanni Turcz., loc. cit. **31**(1): 229. 1858.
Triumfetta quinqueloba Turcz., loc. cit. **36**(1): 574. 1863.

Shrub ca. 0.60-2.50 m. high, the branches and inflorescence-axes ferruginous-pubescent. *Leaves* with a petiole ca. 2-8 cm. long or sometimes slightly more, ferruginous-arachnoid, the blade broadly ovate, sometimes pandurate, often 3- to 5-lobate, the lobe tips, at least the terminal, acuminate, ca. 8-10 cm. long and 7-9 cm. wide, the margins irregularly serrate, the serrations usually glandular, the upper surface pubescent, the lower one arachnoid to pubescent, 3- to 5-palminerved, the nervation slightly prominent beneath. *Inflorescences* axillary, the cymes of 2, rarely 3 cymules, generally condensed, the bracts ovate to more or less elliptic, rarely obscurely 3-lobate, the peduncles and pedicels short, 1-2 mm. long, sparsely hirsute. *Flowers* 4.5-5.5 mm. long, hermaphrodite, the sepals 5, narrowly oblong, acute, with a very short apical appendage ca. 0.5 mm. long, ca. 4.5-5.5 mm. long and 0.5 mm. wide, fleshy, sparsely hirsute without, glabrous within; petals absent; gonophore and urceolus obsolete, the glands absent; stamens (5-)10(-15), the filaments ca. 3-4 mm. long, glabrous, the anthers ca. 0.5 mm. long; ovary suborbicular, ca. 0.6-0.8 mm. in diam., covered with numerous uncinate spinules; style ca. 3-3.5 mm. long, the stigma obscurely 2- to 3-parted. *Fruit* broadly elliptic, the body 3-4 mm. long and 2.5-3 mm. broad, lightly stellate-pubescent, the spines about 50, ca. 1.8-2 mm. long, retrorsely pilosulose, the spinules uncinate, 2- or 3-celled, each cell 1-seeded; seeds pyriform, ca. 1.5-2 mm. long and 1-1.5 mm. wide.

Common throughout tropical America; usually in dry open habitats, often in secondary formations; known as *cadillo* and *cepa de caballo.*

BOCAS DEL TORO: Changuinola Valley, *Dunlap 122, 372, 433;* vicinity of Chiriquí Lagoon, Old Bank Island, *von Wedel 1883, 1949, 2005;* Water Valley, *von Wedel 1710, 1779, 1825, 1847, 1854;* Darkland, *von Wedel 2618.* CANAL ZONE: Chagres, *Fendler 172;* vicinity of Fort Sherman, *Standley 30993;* near Fort Randolph, *Standley 28638;* Mount Hope Cemetery, *Standley 28828;* Gatun, *Bro. Heriberto 124, Hayes 370, 991;* hills west of the Canal, near Gatun, *Standley 27275;* around the Agua Clara Reservoir, near Gatun, alt. 20-30 m., *Maxon 4660;* Barro Colorado Island, *Shattuck 657, 728, Wetmore & Abbe 88, 174, Wilson 41, Wood-*

worth & Vestal 627; Frijoles, *Standley 27638;* Darien Station, *Standley 31523;* Gamboa, *Standley 28533;* Obispo, *Standley 31735;* Summit, *Standley 26941;* around Culebra, alt. 50-150 m., *Pittier 2145;* vicinity of Miraflores Lake, *P.White 279;* Corozal, *Standley 27392;* vicinity of Corozal, *Piper 5302, 5308;* Ancon Hill, 600 ft., *R. S. Williams 21;* Balboa, *Standley 27124, 32110.* COCLÉ: Aguadulce, near sea level, *Pittier 4961;* El Valle de Antón, trails near Finca Tomas Arias, 600 m., *Allen 4229.* COLÓN: between France Field, Canal Zone and Catival, *Standley 30242, 30423;* Rio Viejo, vicinity of Puerto Pilon, 10 m., *Allen 4100;* Juan Mina plantation, Río Chagres, Region above Gamboa, 25 m., *Allen 4125.* DARIEN: trail between Caná and Boca de Cupe, vicinity of El Real, along road to Río Pirre, *Stern, Chambers, Dwyer, Ebinger 610*; locality unknown, *Macbride 2686.* HERRERA: vicinity of Ocú, 100 m., *Allen 4056.* PANAMA: vicinity of San Carlos, alt. 0-10 m., *Allen 1138;* between Capira and Potrero, 80-130 m., *Dodge & Hunter 8626;* along the Corozal Road, near Panama, *Standley 26792;* Sabanas northeast of Panama City, *Bro. Paul 184;* Paitilla, *Bro. Heriberto 236;* Punta Paitilla, *Standley 30805;* Bella Vista, *Standley 25339;* Agricultural Experiment Station at Matias Hernández, *Pittier 6926;* Rio Tapía, *Standley 26126, 28057;* near the big swamp east of the Río Tocumen, *Standley 26698;* Tocumen area, *Dwyer 4884;* Brujas, *Mell s.n.;* Taboga Island, *Standley 27043, 27989.* VERAGUAS: vicinity of Santiago, alt. ca. 50 m., *Allen 1084.* PROVINCE UNKNOWN: *Carleton 122, Hayes 321.*

9. DICRASPIDIA Standley

DICRASPIDIA Standley, Field Mus. Nat. Hist., Bot. Ser. **4:** 226. 1929.

Shrubs or small trees, the pubescence of simple and stellate hairs, often also with gland-tipped hairs. *Leaves* alternate, petiolate, 2-stipulate, the stipules intra-axillary, persistent, unequal, one filiform, the other large, peltate and foliaceous, the blade dentate, palminerved. *Flowers* supra-axillary, solitary, large, hermaphrodite, actinomorphous, long-pedicellate, 5-merous; calyx subepiginous, valvate, the sepals provided along the margins and at the apex with long filiform appendages, persistent; corolla subepiginous, the petals free, longer than the calyx, glandless; stamens numerous, all fertile, subepiginous, free, the filaments short and filiform, the anthers 2-thecate, basifixus, versatile, longitudinally dehiscent from the apex to the base; ovary subinferior to inferior, 10- to 12-celled (probably initially 5-celled, but irregularly divided by false partitions), the cells many-ovulate; style simple, thick and short; stigma 5-dentate. *Fruit* baccate, surmounted by the persistent sepals, indehiscent, the epicarp thin; seeds, numerous, small.

A neotropical, monotypic genus, occuring only in Honduras, Costa Rica and Panama. This genus is easy to recognize by the characteristic leaflike, peltate stipules, by the numerous, long, filiform appendages of the calyx and by the position of the ovary which is almost inferior. The affinity of this genus to other members of the family is obscure.

1. DICRASPIDIA DONNELL-SMITHII Standley, Field Mus. Nat. Hist., Bot. Ser. **4:** 227. 1929.—Fig. 9.

Shrub or small tree 3-10 m. high, the bark smooth, the branches whitish-tomentose and long-hirsute. *Leaves* rather short-petiolate, the petiole terete, 1-1.5 cm. long, whitish-tomentose and long-hirsute, the stipules unequal, one filiform and 1-1.2 cm. long, the other foliaceous, peltate, very short and eccentricaly stipitate, suborbicular, up to 4.5 cm. in diam., sparsely pilose above and whitish-tomentose beneath; blade oblong to oblong-subobovate, somewhat asymmetric and slightly

Figure 9. DICRASPIDIA DONNELL-SMITHII Standley: A, leaves and stipules (× ⅔); B, flower (× ⅔); C, anther (× 1⅓); D, longitudinal section of ovary (× 1⅓); E, fruit surmounted by the persistent calyx (× ⅔).

cordate at the base, acuminate at the apex, 10-20 cm. long and 3-8 cm. wide, membranous, the margins very irregularly dentate, the teeth acute to more or less blunt, the upper surface dark green and sparsely pilose, the lower surface whitish-tomentose, 5- to 7-palminerved, the nervation prominent beneath. *Flowers* long-pedicellate, the pedicel slender, 4.5-5 cm. long, tomentose and long-hirsute; receptacle ca. 0.8 cm. in diam., tomentellous and long-hirsute; sepals triangular-acuminate, 1-1.6 cm. long (without apical appendages) and 0.5-0.7 cm. wide at the base, tomentose and hirsute outside, densely sericeous inside, each margin provided with 4-5 filiform appendages ca. 0.7-1 cm. long, the apical appendage ca. 1-1.2 cm. long; petals obovate, irregularly and bluntly dentate, 3-4 cm. long and up to 2.8-3.5 cm. wide, thin-membranous, bright yellow, glabrous; stamens with unequal filaments, ca. 0.3-0.7 cm. long, glabrous, the anthers oblong, ca. 1.2-1.5 mm. long; ovary densely villous-arachnoid at the apex, the style thick, enlarged at the base, ca. 0.8 cm. long and 0.25 cm. broad at the base, arachnoid on the lower part, the stigma 5-dentate. *Fruit* baccate, transversely elliptic, ca. 1 cm. long and 1.5-1.8 cm. broad, hirsute-arachnoid; seeds ca. 0.4-0.5 mm. long.

In second growth and along streams.

BOCAS DEL TORO: banks of Changuinola River, *Dunlap 439* (type); lower Changuinola River, *Stork 286*.

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FLORA OF PANAMA[1]

Part VI

FAMILY 116. BOMBACACEAE[2]

BY ANDRÉ ROBYNS[3]

Trees, infrequently shrubs, mucilaginous, armed or unarmed, glabrous or lepidote, or with stellate, tufted, or even simple hairs. *Leaves* alternate, simple or compound-digitate, stipulate, the stipules fugacious. *Inflorescences* cymose or racemose or flowers solitary, sometimes cauliflorous. *Flowers* often bracteolate, small or large, hermaphrodite, seldom imperfect, actinomorphous, rarely more or less zygomorphous, usually 5-merous, with or without epicalyx; receptacle glandular or not; calyx valvate, lobate or truncate, caducous, persistent or accrescent; petals none or 5, contorted, usually adnate to the base of the staminal column; stamens 5 to numerous, usually monadelphous, rarely free; anthers 1- to 2- to many-thecate, free or coherent, hippocrepiform to linear, sometimes anfractuose, usually longitudinally dehiscent, rarely porose; pollen porate, colpate or colporate, with reticulate sexine, provided or not with suprategillar elements or with tegillate and spinulate sexine; staminodes infrequently present; gynoecium with 2-5(-6) or 10(-15) syncarpous carpels; ovary superior, sometimes subinferior, 2- to 5(-6)- or 10(-15)-celled, with (1-)2-many ovules in each cell and with axile placentation; ovules anatropous; style simple; stigma capitate or divided. *Fruit* capsular, smooth or sometimes spinose or samaroid, usually opening by 3 or 5 valves, sometimes more or less long-lanate within, infrequently pulpy and indehiscent; seeds glabrous, sometimes alate or arillate, often oleaginous; albumen generally none or scant; embryo usually curved, sometimes straight; cotyledons epigeal, plane or folded, foliaceous or carnose.

A pantropical family of about 26 genera, particularly well developed in tropical America; nine genera are represented in Panama. The capsules of some genera (*Bombax* L., *Ceiba*, *Ochroma*) are filled with wooly fibers, commonly named kapok; *Adansonia* L., *Bombacopsis*, *Durio* Adans. and *Pachira* have edible seeds; and the genus *Ochroma* furnishes the well-known balsa wood.

a. Leaves compound-digitate; capsule loculicidally dehiscent.
  b. Seeds not winged.
    c. Staminal column divided into many filaments, each bearing a single anther, these hippocrepiform to oblong-linear.

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1. The Flora of Panama by Robert E. Woodson, Jr. and Robert W. Schery and Collaborators should be cited as: Ann. Missouri Bot. Gard., with volume number, pagination and date of the Annals.

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d. Leaflets inarticulate; capsule densely long-lanate within .... 1. PSEUDOBOMBAX

dd. Leaflets articulate.

e. Deciduous trees; capsule densely long-lanate within; seeds numerous, 0.4-1 cm. long and 0.35-0.95 cm. wide...... 2. BOMBACOPSIS

ee. Evergreen trees; capsule silky-villous within; seeds few, 2-3.2 cm. x 2.2-6 cm. x 2-2.2 cm. .... 3. PACHIRA

cc. Staminal column divided into 5 filaments, each bearing 2-3 anfractuose anthers or 2 superposed, linear and slightly flexuose anthers.... 4. CEIBA

bb. Seeds broadly winged; stamens 5, the staminal column long, the anthers almost sessile, elongated, spirally twisted, vermiform .... 5. GYRANTHERA

aa. Leaves simple.

f. Capsule indehiscent.

g. Staminal column separating into many pentadelphous filaments, each bearing a single anther; ovary superior; capsule with 5 membranous wings much enlarged laterally .... 6. CAVANILLESIA

gg. Staminal column undivided or shortly 5-dentate to 5-lobate, the anthers sessile to subsessile; ovary subinferior; capsule not winged .... 7. QUARARIBEA

ff. Capsule loculicidally dehiscent.

h. Flowers small, up to 1.8 cm. long, either hermaphrodite or staminate; staminal column divided into many unequal filaments, each bearing a single anther; ovary and capsule 3-celled; capsule glabrous or nearly so within; seeds arillate .... 8. HAMPEA

hh. Flowers large, up to 11-15 cm. long, hermaphrodite; staminal column shallowly 5-lobate, antheriferous from about the middle to the apex, the anthers sessile; ovary and capsule 5-celled; capsule densely lanate within; seeds not arillate .... 9. OCHROMA

1. PSEUDOBOMBAX Dugand

PSEUDOBOMBAX Dugand, Caldasia **2:** 65. 1943.

Trees or sometimes shrubs, deciduous, mostly unarmed, the trunk straight or spindle-shaped, the young branches generally whitish-pruinose. *Leaves* petiolate, compound-digitate or seldom simple; digitate leaves 3- to 9(-11)-foliolate, the leaflets inarticulate, sessile or petiolulate and entire; simple leaves with inarticulate and entire blade. *Inflorescences* cymose, the cymes 2- to 5-flowered, unipared or not, or flowers solitary. *Flowers* hermaphrodite, actinomorphous, pedicellate, 3-bracteolate, the bracteoles fugacious or not; receptacle mostly glandular; calyx cupuliform, campanulate or subtubiform, truncate to shortly 5-lobate, coriaceous, accrescent; petals 5, adnate to the base of the staminal column, fleshy, with tufted hairs, fugacious; stamens 150-1,500, apparently 1-whorled, the staminal column divided into many filaments or into 5-10 or 15 distinct phalanges, the anthers 1-thecate, hippocrepiform, medifixus, extrorse, longitudinally dehiscent; pollen colpate or colporate, the sexine reticulate; ovary superior, sessile, 5(-6-8)-celled, the cells many-ovulate, the ovules inserted on a central columella; style filiform; stigma capitate or 5(-6-8)-lobulate. *Capsules* subligneous, loculicidally 5(-6-8)-valvate, the central columella winged and persistent; seeds numerous, small, pyriform, imbedded in copious whitish to reddish kapok; cotyledons epigeal and expanded above the ground level, opposite, petiolate, equal, folded, foliaceous to slightly coriaceous, the primordial leaves simple.

A neotropical genus of 20 species of which only one occurs in Panama.

1. PSEUDOBOMBAX SEPTENATUM (Jacq.) Dugand, Caldasia **2:** 65. 1943; A. Robyns, Bull. Jard. Bot. État Brux. **33:** 32, *pl. 1.* 1963.—Fig. 1.

Bombax septenatum Jacq., Enum. Syst. Pl. 26. 1760.
Bombax heptaphyllum L., Sp. Pl. ed.2, 960. 1763, non L., Syst. Nat. ed.12, 457. 1767.
Pachira Barrigon Seem., Bot. Voy. Herald 83. 1853.
Bombax Barrigon (Seem.) Decne., Fl. Serres **23:** 44. 1880.
Bombax balanoides Ulbr., Notizbl. K. Bot. Gart. Mus. Berlin **6:** 156. 1914.
Bombax carabobense Pittier, Bol. Com. Ind. Venezuela **4**(34): 32. 1923.

Tree 6-20 m. tall, the trunk spindle-shaped, ca. 80 cm. in diam. at the base and 1.40 m. in diam. at the largest portion, the crown rounded, the branches more or less horizontal, the bark grayish with longitudinal, greenish furrows, glabrous and rimose, the branchlets whitish-pruinose. *Leaves* 5- to 9-foliolate, the petiole thick, slightly enlarged at the base, 8.5-34(-68) cm. long, the leaflets sessile to shortly petiolulate, the petiolule 0.4-1.2 cm. long and canaliculate above; blade obovate, elliptic to seldom oblong-elliptic, cuneiform and decurrent at the base, more or less bluntly apiculate at the apex, 5-29 cm. long and 2.6-14 cm. wide, glabrous above, glabrous or sometimes with scattered small lepides beneath, the nerves prominent beneath. *Inflorescences* cymose, the cymes 3-flowered and unipared, or flowers solitary. *Flowers* 7-10 cm. long, the pedicel 1.8-4(-6) cm. long and 0.3-0.5 cm. in diam., glabrous; receptacle provided with 1 or sometimes 2 whorls of glands, glabrous or sometimes lepidote; calyx cupuliform to cupuliform-campanulate, truncate, 0.8-1.4 cm. long and 1.9-3 cm. wide, generally reddish-lepidote without, silky-tomentellous within; petals linear-lanceolate, subacute, 6.5-9.5 cm. long and 1.8 cm. wide, pinkish to cream-colored, tomentellous outside, pubescent-striate inside; stamens 1,000-1,200, the staminal column 0.8-1.8 cm. long and 0.6-1.2 cm. in diam., glabrous at the base, elsewhere shortly silky to pubescent, divided into 5 dichotomous phalanges 4.3-6.5 cm. long; anthers ca. 2-2.5 mm. long; ovary conical, conical-oblong to subglobose, 5-angular or terete, 0.4-0.9 cm. long and 0.4-0.7 cm. in diam. at the base, generally papillate; style 6.5-10 cm. long, slightly enlarged at the apex, glabrous; stigma 5-lobulate, the lobes ca. 1 mm. long. *Capsule* ovoid-fusiform, 5-angular, 12-15 cm. long and 5-7 cm. in diam., sometimes papillate when young, quickly glabrate; seeds broadly pyriform, ca. 0.6 cm. long and 0.5 cm. wide, dark brown; kapok white-grayish.

From Nicaragua to Panama, Colombia, Venezuela, Brazil (Territorio do Acre) and Peru; on forested hills, in pastures, along roads, usually on sandy soil; often planted; known as *barrigón* in Panama.

CANAL ZONE: Chagres, Isthmus of Panama, *Fendler 312;* Gatun, *Hayes 718;* Barro Colorado Island, *Shattuck 614, Wetmore & Abbe 110;* around El Paraiso, alt. 30-100 m., *Pittier 2512;* around Culebra, alt. 50-150 m., *Pittier 2154;* Balboa, *Standley 28537;* locality unknown, *Harvey 5230, Johansen s.n.* DARIEN: vicinity of Pinogana, *Allen 4295.* PANAMA: Matias Hernández, Agricultural Experiment Station, *Pittier 6935;* near Matias Hernández, *Standley 28947;* Río Tocumen, *Standley 29460;* Sotto Caballo, near Madden Lake, *C. E. Smith, M. H. Smith & Arrauz 3320;* Taboga Island, *Seemann 1632.* PROVINCE UNKNOWN: *Dodge & Allen s.n.*

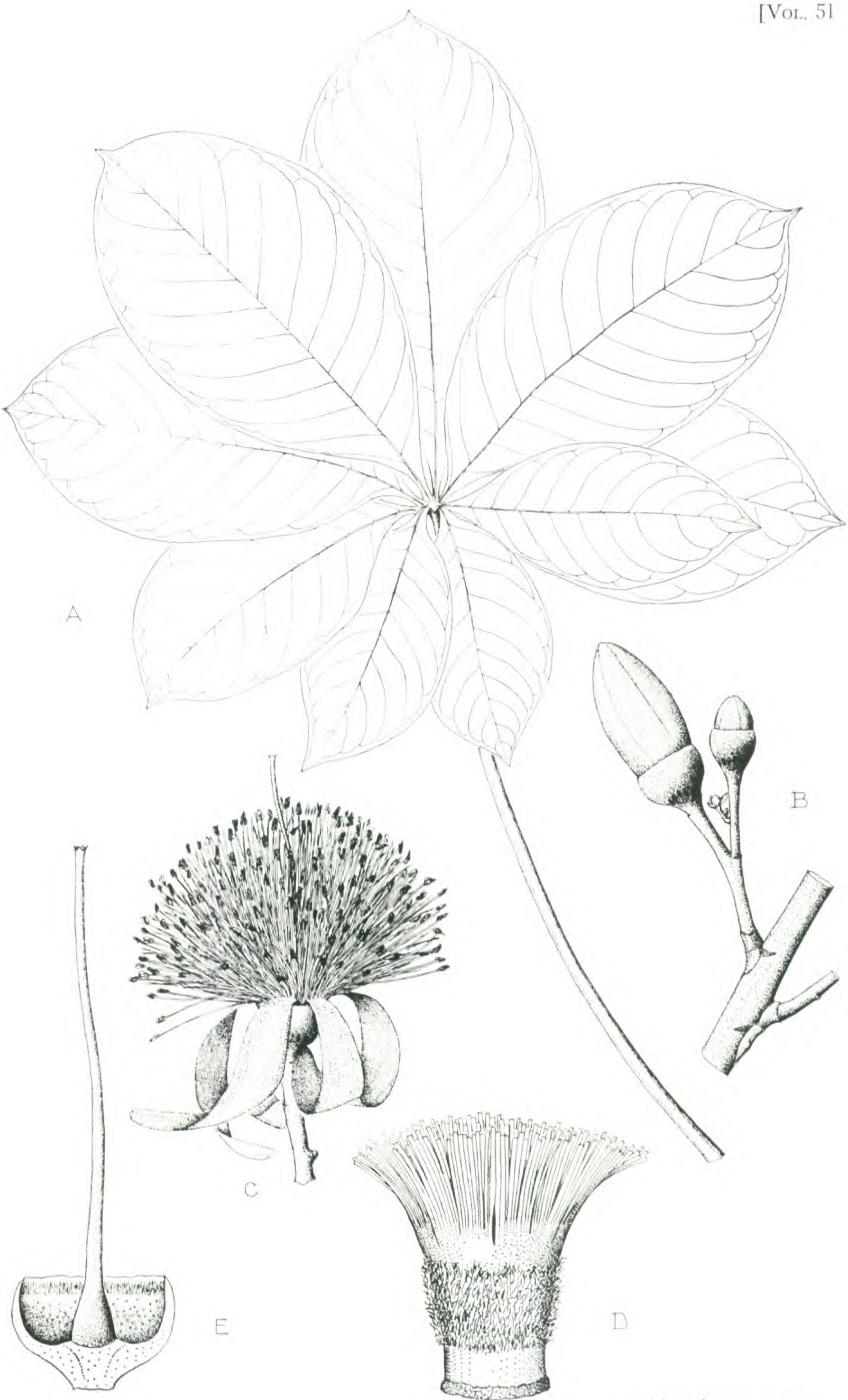

Figure 1. Pseudobombax septenatum (Jacq.) Dugand: A, leaf (× ½); B, inflorescence (× ½); C, flower (× ½); D, staminal tube (× 2); E, longitudinal section of calyx and gynoecium (× 1) (from Bull. Jard. Bot. État Brux.).

2. BOMBACOPSIS Pittier

BOMBACOPSIS Pittier, Contr. U. S. Nat. Herb. **18:** 162. 1916.

Bombax L. sect. *Pachiropsis* K. Schum. in Mart., Fl. Bras. **12**(3): 216. 1886, pro parte.
Pochota Ramirez Goyena, Fl. Nicaragüense 198. 1909.
Bombax sect. β *Ceiba* Bakh., Bull. Jard. Bot. Buitenz. ser. 3, **6**: 175. 1924, pro parte.

Shrubs or trees, deciduous or evergreen, unarmed or sometimes armed, the trunk buttressed or not. *Leaves* petiolate, the stipules lanceolate, the blade compound-digitate, the leaflets 3-11, articulate, sessile or petiolulate, entire. *Inflorescences* cymose, the cymes paniculiform and pauciflorous, or generally flowers axillary or subterminal, solitary, geminate or sometimes 3-nate. *Flowers* hermaphrodite, actinomorphous, 7-25.5 cm. long, pedicellate, 3-bracteolate, the bracteoles fugacious; receptacle glandular or not; calyx cupuliform to tubiform, truncate or 3- to 5-lobate, coriaceous or rarely spathaceous, persistent or accrescent; petals 5, oblong to narrowly ribboned, sometimes oblanceolate or spatulate-linear, adnate to the base of the staminal column, fleshy, with tufted hairs on both sides; stamens 100-1,000, 1- or apparently 2-whorled, the staminal column divided into 5 or 10 or 15 phalanges; anthers 1-thecate, oblong to linear, sometimes slightly curved or seldom hippocrepiform, submedifixus, extrorse, longitudinally dehiscent; pollen zonicolpate or zonicolporate, the sexine of the walls reticulate and often provided with rugulate elements, that of the mesocolpia sometimes echinulate; ovary superior, sessile, 5-celled, the cells many-ovulate, the ovules inserted on a central columella; style filiform; stigma 5-lobulate. *Capsules* subligneous to ligneous, loculicidally 5-valvate, the central columella winged and persistent; seeds few to numerous, small to large, pyriform to ovoid-angular, sometimes polyembryonate, imbedded in few to copious whitish to reddish kapok; cotyledons epigeal and expanded above the ground level, alternate to more or less opposite, petiolate or subsessile, unequal, coriaceous, the primordial leaves simple or compound-digitate.

A neotropical genus (one species, *Bombacopsis glabra* (Pasq.) A. Robyns, however, occurs in tropical America and in tropical Africa) of about 21 species of which only two are reported from Panama.

a. Unarmed tree; flowers 13-24 cm. long; pedicel, receptacle and calyx without glabrous; stamens ca. 280; ovary tomentellous; capsule ellipsoid, caudate-acuminate at the apex; seeds 9-10 mm. long .... 1. B. SESSILIS
aa. Armed tree; flowers 7-11 cm. long; pedicel, receptacle and calyx without puberulous to tomentellous; stamens 100-166; ovary glabrous; capsule oblong-ovoid, emarginate and mucronulate at the apex; seeds ca. 4-5 mm. long .... 2. B. QUINATA

1. BOMBACOPSIS SESSILIS (Benth.) Pittier, Contr. U. S. Nat. Herb. **18:** 162. 1916; A. Robyns, Bull. Jard. Bot. État Brux. **33:** 180. 1963.—Fig. 2.

Pachira sessilis Benth., Bot. Voy. Sulphur 70. 1844.
Pachira angusta Duchassaing ex Decne., Fl. Serres **23**: 52. 1880, nom. nud. in syn.
Bombax sessile (Benth.) Bakh., Bull. Jard. Bot. Buitenz. ser. 3, **6**: 180. 1924; Johnston, Sargentia **8**: 200. 1949.

Tree, deciduous, medium-sized to generally tall, up to 20-30 m. high, the trunk straight, 20-40(-50) cm. in diam. and buttressed, the crown narrow and loose, the branches more or less horizontal, the bark smooth, squamous and greenish. *Leaves* (4-)5- to 7- to 9-foliolate and glabrous, the petiole terete, slightly enlarged on both ends, 2.5-14.5 cm. long; leaflets sessile to subsessile, the blade oblanceolate to obovate, cuneiform at the base, emarginate and mucronulate or sometimes rounded to obtuse and mucronulate at the apex, 2.5-18.5 cm. long and 1.2-6.5 cm. wide, rigid and chartaceous, bright above, dull below, the nerves slightly prominent on both sides. *Flowers* precocious, clustered toward the tip of the branchlets, axillary, solitary, geminate or seldom 3-nate, 13-24 cm. long, the pedicel rounded, 0.5-1.8(-3.2) cm. long and glabrous; receptacle 5-glandular and glabrous; calyx cupuliform to campanulate-subtubiform, truncate or 5-lobulate to undulate and mucronulate, 0.7-1.2 cm. long and 0.85-1 cm. broad, glabrous without, silky-villose within; petals ribboned, acute, 13-24 cm. long and 0.55-0.95 cm. wide, puberulous on both sides; stamens ca. 280, the staminal column 6.5-9(-11.4) cm. long and 0.2-0.4 cm. in diam., glabrous or seldom with 5 narrow, vertical, scatteringly puberulent zones, divided into many pentadelphous filaments, the filaments 5.5-9 cm. long, glabrous and generally bifurcated near the apex; anthers oblong, ca. 0.15-0.2 cm. long; ovary ovoid, 5-angular, ca. 3 mm. long and 4.5 mm. in diam. at the base, tomentellous; style 13-21 cm. long, hirsute on the lower part; stigma obscurely 5-lobulate. *Capsule* ellipsoid, obtuse at the base, caudate-acuminate at the apex, 6-12.3(-15) cm. long and 3.5-5 cm. in diam., the valves yellowish-brown, scatteringly puberulous to glabrous; seeds numerous, subglobose, sometimes more or less angular, 0.9-1 cm. long and 0.7-0.95 cm. wide, the testa brownish; kapok copious and pale brown.

Costa Rica and Panama, at the edge and in deciduous and evergreen forests; often planted as shade tree; also cultivated in Cuba and Jamaica; called *ceibo* in Panama.

CANAL ZONE: Barro Colorado Island, *Shattuck 647*, *Standley 40970*, *Wetmore, Abbe & Shattuck 80*, *Wetmore & Abbe 80A*, *Woodworth & Vestal 452;* Obispo, *Standley 31752;* around Culebra, *Pittier 2407, 2422, 2769a;* Corozal, *Standley 27370;* Balboa, *Standley 29312;* Ancon, garden of the hospital, *Mason s.n.;* Ancon, *Pittier 2726;* locality unknown, *Harvey 5229*, *Johansen 46*. CHIRIQUÍ: around El Boquete, alt. 1,000-1,300 m., *Pittier 3310*. COCLÉ: Penonomé and vicinity, *R. S. Williams 615*. PANAMA: near Panama, *Hayes 478;* Santa Rita hills and Pueblo Liman, *C. E. Smith, Jr. & H. M. Smith 3413;* Islands Secas Group, *Elmore G2;* Taboga Island, *Hinds s.n.* (type); San José Island, *Johnston 414, 493, 560, 607, 943*, *Erlanson 119*. VERAGUAS: vicinity of Santa Fe, Río Santa María, alt. 1,000 ft., *Allen 4416*. PROVINCE UNKNOWN: *Duchassaing s.n.*

2. BOMBACOPSIS QUINATA (Jacq.) Dugand, Contr. Hist. Nat. Colomb. **1**: 2. 1938; A. Robyns, Bull. Jard. Bot. État Brux. **33**: 224. 1963.

Bombax quinatum Jacq., Enum. Syst. Pl. 26. 1760; Johnston, Sargentia **8**: 198. 1949.
Pachira Fendleri Seem., Bot. Voy. Herald 83. 1853.
Pachira bracteolata Decne., Fl. Serres **23**: 51. 1880.
Bombax Fendleri (Seem.) Benth. ex Jackson, Ind. Kew. 320. 1895.
Pochota vulgaris Ramirez Goyena, Fl. Nicaragüense 199. 1909.
Bombax nicoyense Pittier, Repert. Sp. Nov. **13**: 315. 1914.
Bombacopsis Fendleri (Seem.) Pittier, Contr. U. S. Nat. Herb. **18**: 163, *pl.* 74-78. 1916; Standley, Contr. Arnold Arb. **5**: *pl.* 7(A). 1933.

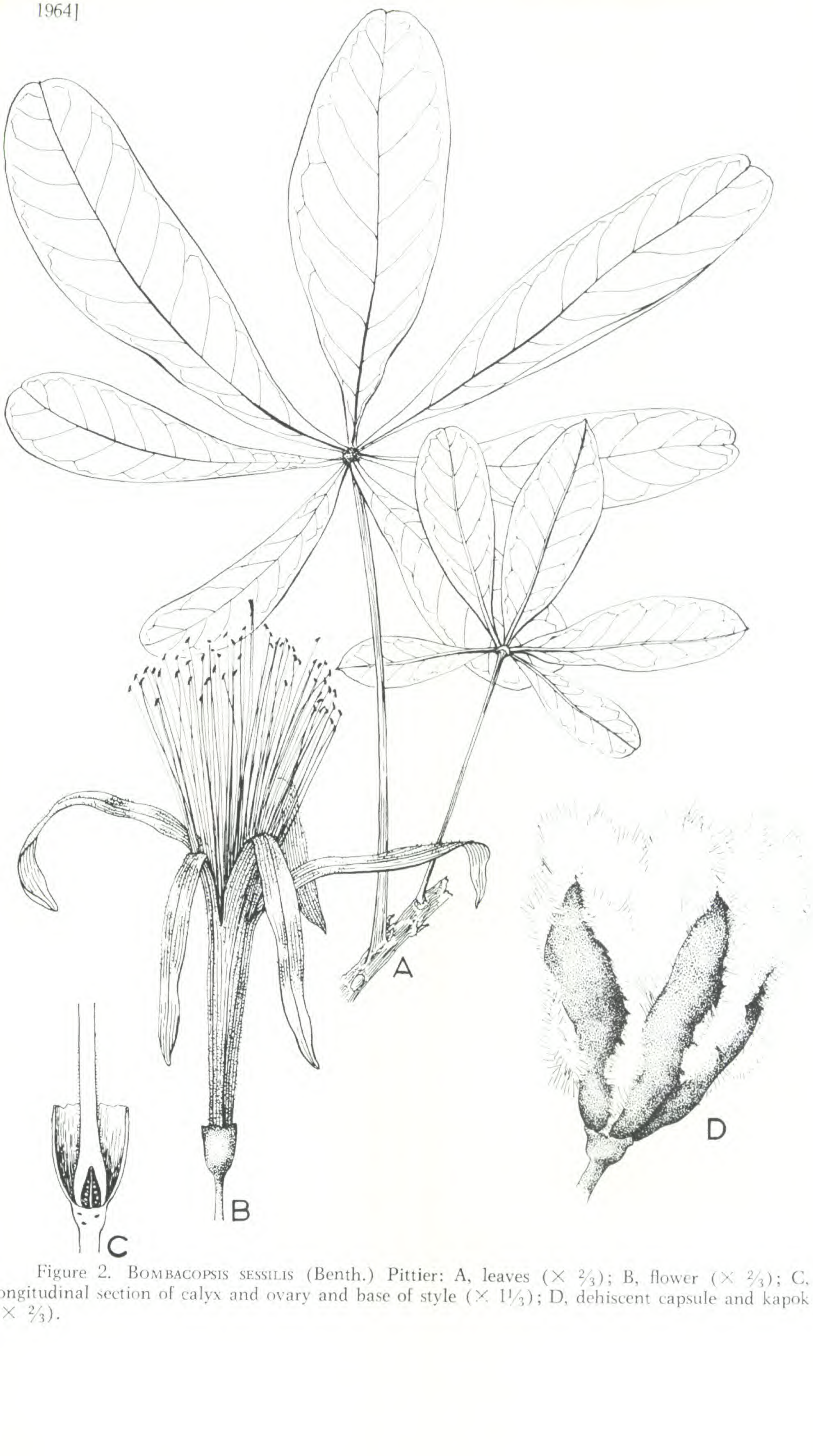

Figure 2. Bombacopsis sessilis (Benth.) Pittier: A, leaves (× ⅔); B, flower (× ⅔); C, longitudinal section of calyx and ovary and base of style (× 1⅓); D, dehiscent capsule and kapok (× ⅔).

Bombacopsis jaris Pittier, Bol. Com. Ind. Venezuela **2**(13): 434. 1921, nom. nud.
Bombacopsis sepium Pittier, Bol. Com. Ind. Venezuela **4**(34): 36. 1923.
Bombax Ceiba sensu Dugand, Caldasia **2**: 61. 1943, non L., Sp. Pl. 511. 1753.

Tree, deciduous, armed, 2.5-30(-40) m. high, the trunk sometimes spindle-shaped at the base, attaining 1-3 m. in diam., often buttressed, the crown broad and rounded, the branches more or less horizontal, the bark grayish to cinnamon, thick and rimose. *Leaves* (3-)5(-6-7)-foliolate and glabrous, the petiole more or less terete, slightly enlarged at both ends, 3-11 cm. long; leaflets petiolulate, the petiolule 0.2-0.8 cm. long, canaliculate above, the blade obovate to oblong-obovate, seldom elliptic, acute or cuneiform and narrowly decurrent at the base, caudate-acuminate or caudate-apiculate and often mucronulate at the apex, 4-17 cm. long and 1.5-7.2 cm. wide, chartaceous to subcoriaceous, the margins sometimes slightly recurved, pale green and bright above, glaucous and dull beneath, the nerves slightly prominent on both sides. *Inflorescences* cymose, the cymes paniculiform and pauciflorous, or flowers solitary. *Flowers* precocious, 7-11 cm. long, the pedicel 0.4-0.8 cm. long, shortly tufted-puberulous to tomentellous, seldom glabrate; receptacle generally 5-glandular, shortly tufted-puberulous to tomentellous; calyx campanulate to campanulate-tubiform, truncate and shortly 5-apiculate or sometimes more or less 5-undulate-apiculate, 0.7-1 cm. long and 0.6-1 cm. broad, shortly tufted-puberulous to tomentellous without, seldom glabrate, silky-villous within; petals linear, subobtuse to subacute, 7-11 cm. long and 0.5-0.8 cm. wide, brownish and densely scabrous-puberulous outside, whitish and arachnoid inside; stamens 100-166, 5.7-9.2 cm. long and whitish, the staminal column slightly dilated at both ends, 1.3-2.2 cm. long, glabrous or arachnoid and chiefly with simple hairs, divided into 5 phalanges, each phalanx with many unequal filaments, 3-7 cm. long; anthers more or less oblong to hippocrepiform, ca. 2-2.5 mm. long; ovary globose to pyriform, more or less 5-angular, ca. 2.5-3 mm. long and 2.2-3.2 mm. in diam. at the base, glabrous; style 6.7-9.5 cm. long and whitish; stigma 5-lobulate, the lobes ca. 1 mm. long. *Capsule* oblong-obovoid, 5-angular, narrowed at the base, truncate, emarginate and mucronulate at the apex, 4-10 cm. long and 2.7-5 cm. in diam., the valves smooth, brownish or cinnamon; seeds numerous, ovoid to subglobose, ca. 4-5 mm. long and 3.5 mm. wide, the testa brown and often grayish-dotted; kapok copious, yellowish-brown to pale brown.

Along the Pacific coast from Nicaragua to Panama, north of Colombia and Venezuela; characteristic tree of the deciduous forests, occasionally in the evergreen forests and dense thickets. One of the local names is *cedro espinoso*.

CANAL ZONE: near mouth of River Chagres, *Allen 872;* Chagres, *Fendler 310;* Barro Colorado Island, *Aviles 102, Shattuck 510, Woodworth & Vestal 669;* around Culebra, alt. 50-150 m., *Pittier 2769;* on the hill back of Paraiso, *Hayes 119;* Victoria Fill, near Miraflores Locks, *Allen 1715.* COCLÉ: Penonomé and vicinity, alt. 50-1,000 ft., *R. S. Williams 227.* PANAMA: Agricultural Experiment Station at Matias Hernández, *Pittier 6940;* forests of Juan Díaz, alt. 20-50 m., *Pittier 2549;* near Chepo, *Kluge 11;* Pedro Gonzalez Island, *Allen 2600;* San José Island, *Erlanson 302, Johnston 215, 569, 1054, 1180.*

3. PACHIRA Aubl.

PACHIRA Aubl., Hist. Pl. Gui. Fr. 725. 1775.

Sophia L., Pl. Surinam. n.86. 1775.
Carolinea L. f., Suppl. Pl. Syst. Veg. 51. 1781.
Bombax L. sect. *Pachira* (Aubl.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. **3**(6): 62. 1895.
Bombax L. sect. *Pachiropsis* K. Schum. in Engl. & Prantl, loc. cit. 62. 1895.

Trees, evergreen, unarmed, the trunk sometimes buttressed. *Leaves* petiolate, the stipules lanceolate, the blade compound-digitate, the leaflets 5-9, articulate, sessile or petiolulate, entire or sometimes undulate, the margins sometimes more or less recurved. *Flowers* grouped toward the end of the branchlets, solitary or geminate, sometimes 3-nate, hermaphrodite, actinomorphous, up to 35 cm. long, pedicellate, 3-bracteolate, the bractlets fugacious; receptacle generally glandular; calyx broadly cupuliform, campanulate to subtubiform, truncate or undulate, coriaceous, persistent; petals 5, ribboned, adnate to the base of the staminal column, fleshy, with tufted hairs on both sides, fugacious; stamens 200-700, apparently 2-whorled, more or less long-monadelphous, the anthers 1-thecate, oblong-linear, straight or curved, submedifixus, extrorse, longitudinally dehiscent; pollen colp(or)ate, the sexine of the walls reticulate and provided with baculate or spinulate, suprategillate elements, that of the mesocolpia sometimes echinulate; ovary superior, sessile, 5-celled, the cells many-ovulate, the ovules inserted on a central columella; style filiform; stigma 5-lobulate. *Capsules* ligneous, large, loculicidally 5-valvate, tufted-pubescent outside, pubescent and with simple hairs inside, the central columella winged and persistent; seeds few, very large and angular; cotyledons epigeal, surrounded by the testa and appressed against the ground level, alternate, sessile, quite unequal, very fleshy and green, the epicotyl provided with triangular cataphylls, the primordial leaves compound-digitate.

A neotropical genus of two species of which only one is reported from Panama.

1. PACHIRA AQUATICA Aubl., Hist. Pl. Gui. Fr. 726, *t.291, 292.* 1775; A. Robyns, Bull. Jard. Bot. État Brux. **33:** 234, *pl. 8, fig. 9-11.* 1963.—Fig. 3.

Carolinea princeps L. f., Suppl. Pl. Syst. Veg. 314. 1781.
Pachira grandiflora Tussac, Fl. Antilles **4:** 12, *pl. 3, 4.* 1827.
Carolinea macrocarpa Schlecht. & Cham., Linnaea **6:** 423. 1831.
Pachira macrocarpa (Schlecht. & Cham.) Walp., Rep. Bot. Syst. **1:** 329. 1842.
Pachira longiflora Hook., Curt. Bot. Mag. **76:***t.4549.* 1850.
Pachira aquatica var. α *surinamensis* Decne., Fl. Serres **23:** 46. 1880.
Bombax aquaticum (Aubl.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. **3**(6): 62. 1895.
Bombax macrocarpum (Schlecht. & Cham.) K. Schum. in Engl. & Prantl, loc. cit. 62. 1895.
Pachira pustulifera Pittier, Repert. Sp. Nov. **13:** 315. 1914.
Pachira villosula Pittier, loc. cit. 316. 1914.
Bombax rigidifolium Ducke, Arch. Jard. Bot. Rio de Janeiro **4:** 127. 1925.
Pachira aquatica var. *occidentalis* Cuatr., Rev. Acad. Colomb. Cienc. **9:** 169. 1954.

Tree 5-23 m. high, the trunk attaining 25-60(-90) cm. in diam., sometimes buttressed, the crown spreading, the bark smooth, grayish to more or less brownish. *Leaves* 5- to 9-foliolate, the petiole terete, often longitudinally furrowed, dilated at

both ends, 4-23.5 cm. long, glabrous; leaflets petiolulate, the petiolule thick, 0.3-2.5 cm. long, often furrowed above and glabrous; blade elliptic to oblong, sometimes lanceolate or slightly obovate, acute or rounded and more or less decurrent at the base, caudate-acuminate, caudate-apiculate or rounded-apiculate and generally mucronulate at the apex, 5-28.5 cm. long and 2.5-14.5 cm. wide, chartaceous to coriaceous, the margins sometimes slightly recurved, generally bright and glabrous above, dull, glabrous or sometimes scatteringly reddish-lepidote or finely tufted-pubescent or seldom lepidote and puberulous beneath, the nerves prominent especially beneath. *Flowers* solitary or sometimes 2- to 3-nate, attaining 17.5-35 cm. long, the pedicel terete, 1-5.5 cm. long and 0.3-1.1 cm. thick, glabrous to shortly yellowish-brown-tufted-puberulous; receptacle 5-glandular, shortly puberulous to tomentellous with yellowish-brown tufted hairs; calyx campanulate, sometimes campanulate-tubiform, truncate or 5-apiculate, sometimes slightly 5-undulate-apiculate, 1.2-2.1 cm. long and 1.3-2 cm. in diam., shortly puberulous to tomentellous with yellowish-brown tufted hairs outside, silky-villose inside; petals acute to more or less obtuse, 17-34 cm. long and 0.8-2.1 cm. wide, greenish, yellowish or whitish, puberulous on both sides; stamens 200-260, 16-31 cm. long, whitish below and scarlet above, the staminal column 4.5-12 cm. long and 0.45-0.8 cm. in diam., tufted-puberulous; outer whorl with 5 dichotomous, epipetalous phalanges, each phalanx with numerous filaments; inner whorl with 5 episepalous phalanges, each phalanx with only 2-8 filaments; anthers ca. 3-5.5 mm. long, reddish; ovary pyriform, 5-sulcate, ca. 0.5-1 cm. long and 0.45-1 cm. broad, shortly whitish-villose; style more or less dilated and 5-sulcate at the base, 19-31 cm. long, white below and reddish above, villous on the third inferior; stigma lobulate, the lobes ca. 2-3 mm. long. *Capsule* subglobose, ellipsoid to oblong-ellipsoid, shallowly 5-sulcate longitudinally, rounded to obtuse and emarginate at the apex, 12.5-30 cm. long and 6-10(-12) cm. in diam., the valves to 1 cm. thick, yellowish-brown-scabrous-puberulous outside, silky-villous inside; seeds generally 4- to 5-angular, 2-3.2 cm. x 2.2-6 cm. x 2-2.2 cm., the testa brownish.

From southern Mexico (Veracruz, Oaxaca, Chiapas, Yucatan) through Central America to Ecuador, northern Peru (Loreto) and northern Brazil (Para, Maranhão); generally riparious, growing along the often (periodically) inundated river banks and lake shores or at the edge of woods, always on moist ground; often cultivated throughout tropical America and in some isles of the Antilles: Cuba, Jamaica, Haiti and Trinidad; also cultivated in Africa and Asia

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Water Valley, *von Wedel 1478, 1805, 2157;* Western River, *von Wedel 2703, 2783, 2792.* CANAL ZONE: Chagres, Isthmus of Panama, *Fendler 311;* Mojinga swamp near mouth of River Chagres, below 1 m., *Allen 857, 859;* Gatun, *Hayes 622;* forest along the Río Indio de Gatun, near sea level, *Pittier 2777;* Barro Colorado Island, *Aviles 40, Frost 149;* Summit, Plant Introduction Gardens, *Harvey 5275, Steyermark s.n.;* Ahorca Lagarto to Culebra, *Cowell 375.* COLÓN: between France Field, Canal Zone and Catival, *Standley 30382;* along river at Portobelo, *Christopherson 401.* DARIEN: along Río Tuira below El Real and Piriaque Island, *Stern, Chambers, Dwyer, Ebinger 971.* PANAMA: near Chepo, *Kluge 29;* banks of Mamoni River, below La Capitana, alt. 20-25 m., *Pittier 4578.*

Figure 3. Pachira aquatica Aubl.: A, flowering branch (× ½); B, indumentum of lower leaf-surface (lepides and simple hairs) (× 25); C, androecium (× ½); D, receptacle, longitudinal section of calyx, ovary and base of style (× 1); E, style-apex and stigma (× 5); F, pollen grain, optical section of the equator in polar view; G, id., equatorial view; H, id., L. O. analysis (from Bull. Jard. Bot. État Brux.).

4. CEIBA Mill.

Ceiba Mill., Gard. Dict. Abridg. ed. 4. 1754.

Eriodendron DC., Prodr. **1**: 479. 1824.
Gossampinus Ham., Trans. Linn. Soc. London **15**: 126. 1826, pro parte quoad *G. alba* Ham.
Erione Schott & Endl., Melet. Bot. 34. 1832.
Campylanthera Schott & Endl., loc. cit. 35. 1832.
Spirotheca Ulbr., Notizbl. K. Bot. Gart. Mus. Berlin **6**: 159. 1914.

Trees, infrequently strangler epiphytes, generally tall, deciduous, armed or unarmed, the trunk buttressed or not. *Leaves* petiolate, compound-digitate; leaflets 5-9, articulate, the blade often denticulate near the apex. *Inflorescences* grouped toward the tip of the branchlets, axillary, fasciculate, or flowers solitary or geminate. *Flowers* hermaphrodite, actinomorphous, sometimes subzygomorphous, with tufted hairs, pedicellate, bracteolate, the bractlets fugacious; receptacle eglandular; calyx campanulate to more or less tubiform, truncate or irregularly lobed, persistent or accrescent; petals 5, adnate to the base of the staminal column, fleshy; stamens 5, the staminal column conical or the lower part cylindric and thickened and the upper part conical, sometimes provided with one whorl of staminodia, the filaments bearing each 1-3 linear to anfractuose anthers; anthers 1- to 2(-4)-thecate, longitudinally dehiscent; pollen colporate, the sexine reticulate; ovary superior to subinferior, sessile, 5-celled, the cells many-ovulate; style filiform or dilated upward; stigma capitate or 5-lobulate. *Capsules* coriaceous to ligneous, loculicidally 5-valvate, the central columella winged and persistent; seeds numerous, obovoid or subglobose, imbedded in copious kapok; cotyledons epigeal and expanded above the ground level, opposite, petiolate, folded and foliaceous.

A pantropical genus of which most of the species are native to tropical America; two species are reported from Panama.

a. Flowers 2.5-4 cm. long; calyx campanulate, 1-1.2 cm. long and 0.9-1.2 cm. wide; staminal column conical, ca. 5-5.5 mm. long and glabrous, each filament bearing 2-3 anfractuose anthers, the anthers 1-thecate; style suddenly obliquely enlarged above the staminal column .... 1. C. pentandra
aa. Flowers 6-9 cm. long; calyx cupuliform, 2.2-2.8 cm. long and 2-3 cm. wide; staminal column 2.5-7 cm. long, the lower part cylindric, thickened and minutely and densely tomentellous, the upper part conical and glabrous, each filament bearing 2 superposed, linear and slightly flexuose anthers, the anthers 2-thecate; style midway suddenly dilated upward .... 2. C. rosea

1. Ceiba pentandra (L.) Gaertn., Fruct. Sem. **2**: 244, *t.133*. 1791.

Bombax pentandrum L., Sp. Pl. 511. 1753.
Ceiba casearia Medic., Malv.-Fam. 16. 1787.
Eriodendron anfractuosum DC. var. α *indicum* DC., Prodr. **1**: 479. 1824.
Eriodendron anfractuosum var. β *caribaeum* DC., loc. cit. 479. 1824.
Eriodendron anfractuosum var. γ *africanum* DC., loc. cit. 479. 1824.
Bombax orientale Spreng. in L., Syst. Veg. ed. 16, **3**: 124. 1826.
Bombax occidentale Spreng. in L., loc. cit. 124. 1826.
Gossampinus alba Ham., Trans. Linn. Soc. London **15**: 126. 1826.
Bombax guineense Thonning in Schumacher, Kong. Danske Vid. Selskabs Nat. Math. Afhandl. **4**: 76. 1829.
Eriodendron guineense (Thonning) G. Don ex Loud., Hort. Brit. 292. 1830.

Eriodendron caribaeum (DC.) G. Don ex Loud., loc. cit. 292. 1830.
Eriodendron occidentale (Spreng.) G. Don, Gen. Syst. Gard. Bot. **1:** 513. 1831.
Gossampinus Rumphii Schott & Endl., Melet. Bot. 35. 1832.
Eriodendron orientale (Spreng.) Kostel., Algem. Med.-Pharm. Fl. 1875. 1836.
Eriodendron pentandrum (L.) Kurz, Jour. As. Soc. Bengal **43:** 113. 1874.
Xylon pentandrum (L.) O. Ktze, Rev. Gen. Pl. **1:** 75. 1891.
Ceiba pentandra var. *clausa* Ulbr. f. *albolana* Ulbr., Notizbl. K. Bot. Gart. Mus. Berlin **6:** 30. 1913.
Ceiba pentandra var. *clausa* f. *grisea* Ulbr., loc. cit. 30. 1913.
Ceiba pentandra var. *dehiscens* Ulbr. f. *albolana* Ulbr., loc. cit. 31. 1913.
Ceiba pentandra var. *dehiscens* f. *grisea* Ulbr., loc. cit. 31. 1913.
Ceiba anfractuosa (DC.) Maza in Maza & Roig, Fl. Cuba 66. 1914.
Ceiba pentandra var. *caribaea* (DC.) Bakh., Bul. Jard. Bot. Buitenz. ser. 3, **6:** 196. 1924.
Ceiba pentandra var. *indica* (DC.) Bakh., loc. cit. 196. 1924.
Ceiba Thonningii A. Chev., Rev. Bot. Appl. Agr. Trop. **17:** 249. 1937.
Ceiba guineensis (Thonn.) A. Chev. var. *ampla* A. Chev., loc. cit. 262. 1937.
Ceiba guineensis var. *clausa* (Ulbr.) A. Chev., loc. cit. 264. 1937.
Ceiba caribaea (DC.) A. Chev., loc. cit. 266. 1937.

Tree up to 40 m. high, the trunk cylindric, often with strong buttresses, 0.8-2 m. in diam., aculeate or not, the crown spherical to pyramidal, the branches usually aculeate, the bark smooth and fibrous. *Leaves* 5- to 9-foliolate, glabrous, the petiole 5-23 cm. long; leaflets with a petiolule 0.5-1.2 cm. long, the blade oblong-lanceolate, slightly narrowed at the base, acuminate at the apex, 10-21 cm. long and 2.3-4.2 cm. wide, the margins sometimes denticulate near the apex. *Inflorescences* fasciculate, few- to many-flowered. *Flowers* 2.5-4 cm. long, the pedicel 2.5-3 cm. long, glabrous; calyx campanulate, 4- to 5-lobate and with more or less rounded lobes, 1-1.2 cm. long and 0.9-1.2 cm. wide, glabrous outside, silky-villous inside; petals obovate-oblong, rounded, 2.5-4 cm. long and 1-1.5 cm. wide, light yellow, villous to tomentose outside except the base, pubescent near the apex inside; staminal column conical, 5-5.5 mm. long, glabrous, the filaments ca. 2.5 cm. long, each bearing 2-3 anfractuose anthers, the anthers 1-thecate; ovary slightly subinferior, globose, glabrous; style filiform at the base, suddenly obliquely enlarged above the staminal column, slightly longer than the stamens; stigma capitate. *Capsule* subligneous, ellipsoid or fusiform, acute at both ends, 10-26 cm. long and 3-4 cm. in diam., dehiscent or not on the tree, the valves ca. 2 cm. wide; seeds numerous, subglobose, 5.5-7 mm. long and 4.4-5.5 mm. wide; kapok copious, grayish.

A pantropical, polymorphic tree growing chiefly in secondary forests, often cultivated and naturalized; the inner walls of the capsules bear the kapok which is used for stuffing pillows, mattresses, etc.; the seeds are oleaginous and used for illumination and soapmaking; the wood is light and sometimes used to make canoes.

CANAL ZONE: Barro Colorado Island, *Carpenter 33, 40.* CHIRIQUÍ: Progresso, *Cooper & Slater 216.*

2. CEIBA ROSEA (Seem.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. **3** (6): 63. 1895.—Fig. 4.

Chorisia rosea Seem., Bot. Voy. Herald 84. 1853.
Xylon roseum (Seem.) O. Ktze, Rev. Gen. Pl. **3**(2): 24. 1898.
Ceiba Allenii Woodson, Ann. Missouri Bot. Gard. **29:** 359. 1942.
Spirotheca Allenii (Woodson) Cuatr., Rev. Acad. Colomb. Cienc. **9:** 167. 1954.

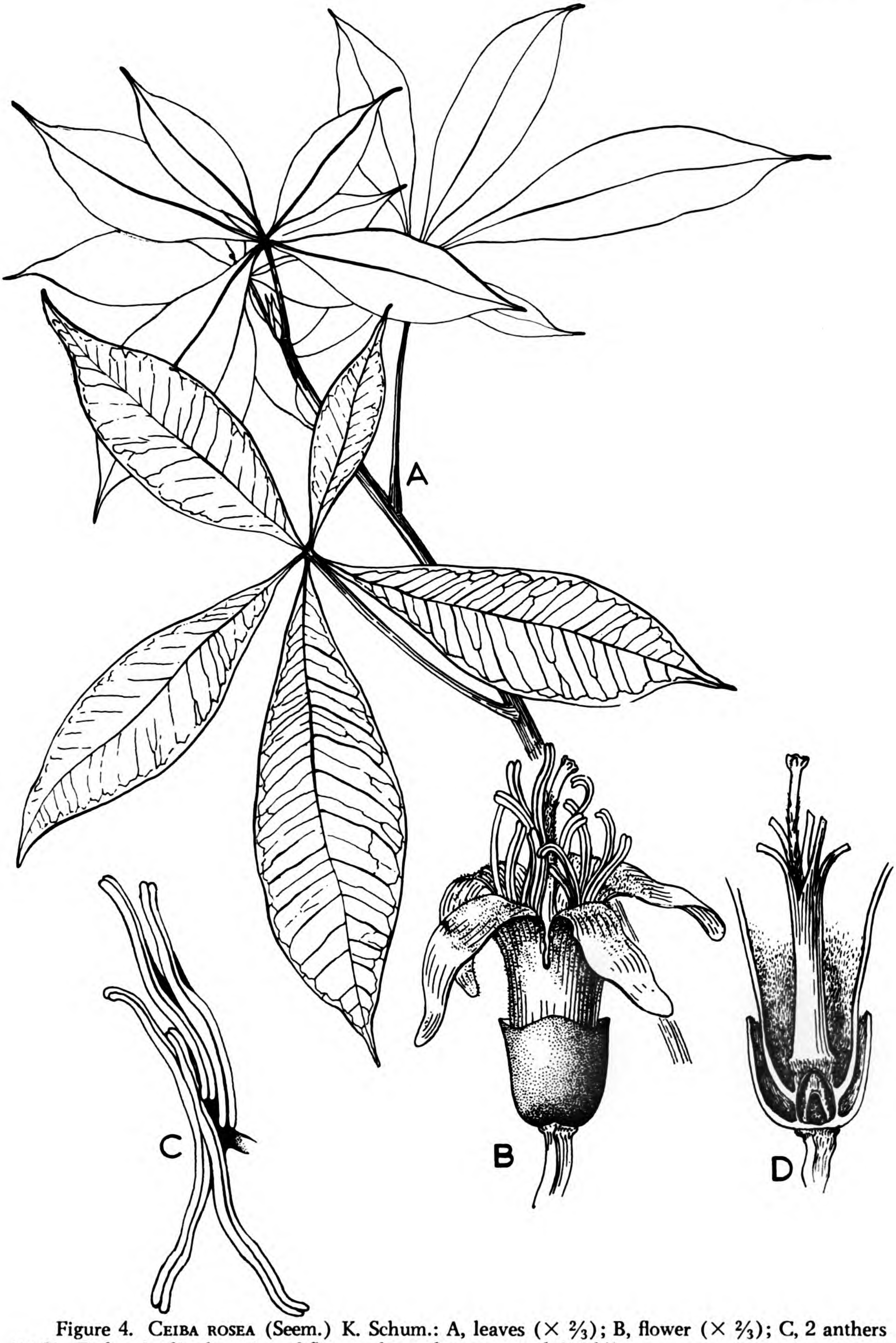

Figure 4. Ceiba rosea (Seem.) K. Schum.: A, leaves (× ⅔); B, flower (× ⅔); C, 2 anthers (× 2); D, longitudinal section of flower, the anthers removed (× ⅔).

Tree, sometimes strangler epiphyte (according to *Allen 2924*), 10-22 m. tall, the trunk up to 40 cm. in diam., the branchlets thick, rimose and aculeate. *Leaves* 5- to 6-foliolate, glabrous, the petiole 5.5-11 cm. long; leaflets shortly petiolulate, the blade slightly obovate, acute and decurrent at the base, acuminate at the apex, 4.5-11.5 cm. long and 1.5-3.8 cm. wide, the nerves prominent especially beneath. *Flowers* grouped toward the apex of the branchlets, solitary or sometimes geminate, 6-9 cm. long, the pedicel thick, ca. 2 cm. long and 0.5-0.7 cm. broad, glabrous; calyx cupuliform, 2- to 5-lobulate, 2.2-2.8 cm. long and 2-3 cm. broad, glabrous outside, silky-villous inside, persistent; petals oblong, rounded, 6-9 cm. long and ca. 1.5 cm. wide, thick, old rose outside, creamy white inside, shortly tomentellous on both sides; staminal column 2.5-7 cm. long, the lower part cylindric, thickened, 1-2.5 cm. long and ca. 1 cm. in diam., shortly tomentellous, the upper part conical, 1.5-4.5 cm. long and glabrous, the filaments 1.5-2 cm. long and bearing each 2 superposed anthers; anthers linear and slightly flexuose, 2-thecate, the thecae parallel, the upper anther ca. 1.8 cm. long and bilobulate at the apex, the lower one ca. 2.4-2.8 cm. long and deeply bifid at the base; ovary superior, oblong, 0.8-1.6 cm. high and 0.5-0.8 cm. in diam., shortly tomentellous; style more or less 5-angular, 3-4.5 cm. long, midway suddenly dilated upward, scatteringly and shortly velutinous near the base; stigma obscurely and bluntly lobulate. *Capsule* unknown.

Native to Panama, on hills and forested slopes.

COCLÉ: region north of El Valle de Antón, 800-1,000 m., *Allen 2924;* Cerro Pajita, 1,000-1,200 m., *P. & D. Allen 4193.* DARIEN: Cerro de Garagara, Sambu basin, 500-974 m., *Pittier 5673.* VERAGUAS: vicinity of Santa Fe, Cerro Tute, 2,500 ft., *Allen 4413.*

I have not seen the type specimen: Veraguas, Volcano of Chiriquí, *Seemann s.n.*

5. GYRANTHERA Pittier

GYRANTHERA Pittier, Repert. Sp. Nov. **13:** 318. 1914.

Trees, tall, deciduous, unarmed. *Leaves* petiolate, the stipules lanceolate, the blade compound-digitate, the leaflets 3-7 (articulate?), petiolulate, entire. *Inflorescences* terminal, unilaterally paniculate. *Flowers* large, hermaphrodite, actinomorphous or slightly zygomorphous, pedicellate, 3-bracteolate, the bracteoles very small and fugacious; receptacle eglandular; calyx tubiform, 2- or 3-lobulate, coriaceous, caducous; petals 5, adnate to the base of the staminal column, fleshy; stamens 5, the staminal column long, sometimes provided near the apex with 2 more or less regular whorls of staminodes, these simple, bifid or trifid, the anthers 5, subsessile to long-stipitate, dorsifixus, extrorse, elongated, spirally twisted, vermiform, 2-thecate, the thecae parallel, transversely septate (according to Pittier, Jour. Wash. Acad. Sci. **16:** 209. 1926), longitudinally dehiscent; ovary superior, sessile, 5-celled, the cells many-ovulate; style filiform, longer than the stamens; stigma briefly 5-parted. *Capsules* coriaceous or subligneous, unilocular, loculicidally dehiscent; seeds few, large, broadly winged, in 2 longitudinal, opposite series, with the wings alternately arranged, albuminous.

Figure 5. Gyranthera darienensis Pittier: A, leaves (× ⅔); B, flower, 1 petal removed (× ⅔); C, longitudinal section of ovary (× 2).

A neotropical genus of only two species: *G. darienensis* Pittier, which is endemic in Panama, and *G. caribensis* Pittier (Bol. Com. Ind. Venezuela **2** (13): 432. 1921), which is native to Venezuela.

1. GYRANTHERA DARIENENSIS Pittier, Repert. Sp. Nov. **13:** 318. 1914.—Fig. 5.

Tree up to 25 m. high, the trunk straight, 0.40-1.20 m. in diam., the branchlets glabrous. *Leaves* 3- to 5-foliolate, the petiole terete, slightly enlarged at the base, 7-22 cm. long and glabrous, the stipules ca. 2 cm. long; leaflets with a petiolule 0.8-1.6 cm. long, the blade oblong-elliptic, sometimes slightly oblong-obovate, obtuse to subacute and narrowly decurrent at the base, bluntly caudate-acuminate at the apex, 11-21 cm. long and 3.5-9 cm. wide, coriaceous, glabrous above, very minutely reddish-lepidote to glabrous and with the nerves prominent beneath. *Flowers* ca. 16 cm. long, the pedicel 4-6 cm. long and ca. 0.5 cm. thick, shortly stellate-puberulous especially near the apex; calyx 2-lobulate, 7 cm. long and ca. 1.6 cm. in diam., the lobes more or less rounded and ca. 1.2 cm. long, shortly ferruginous-stellate-puberulous outside, silky-villous inside; petals oblong-linear, obtuse, 15 cm. long and ca. 2 cm. wide, white, stellate-puberulous especially outside; staminal column cylindric, 11-12.5 cm. long, stellate-puberulous to glabrous, without staminodes, the anthers almost sessile, the lower half adnate to the staminal column, ca. 5.5 cm. long; ovary subglobose, slightly 5-costate, ca. 4-5 mm. long and 5-6 mm. in diam., densely ferruginous-papillate; style up to 19-20 cm. long. *Capsule* unknown; seeds more or less angular, 2-2.6 cm. long, 1.7-2 cm. wide and 1-1.3 cm. thick, the testa dark brown, the wing more or less oblong, rounded to subacute, 12-13.5 cm. long and 3.5-4.5 cm. wide, brown and suberous.

SAN BLAS: high hills back of Puerto Obladia, alt. 50-200 m., *Pittier 4322* (type); locality unknown, *Cooper III 291*.

6. CAVANILLESIA Ruiz & Pavon

CAVANILLESIA Ruiz & Pavon, Fl. Peruv. Chil. Prodr. 97, *t.20.* 1794.

Pourretia Willd. in L., Sp. Pl. ed.4[i.e. 5], **3:** 844. 1800, non Ruiz & Pavon, loc. cit. 46, *t.7.* 1794.

Trees, large, deciduous, unarmed, the trunk sometimes spindle-shaped. *Leaves* simple, petiolate, the stipules ovate, the blade entire or palmatilobate, sometimes cordate at the base. *Flowers* disposed in axillary, umbelliform cymes, hermaphrodite, actinomorphous, pedicellate, 3-bracteolate, the bractlets fugacious; receptacle eglandular; calyx campanulate, 5-lobate, coriaceous, tufted-pubescent outside, accrescent; petals 5, adnate to the base of the staminal column, fleshy, tufted-pubescent; stamens numerous, the staminal column cylindric, narrowed near the apex, divided into many pentadelphous filaments, the anthers 1-thecate, reniform, medifixus, extrorse, longitudinally dehiscent; ovary superior, sessile, 3- to 5-celled, the cells 2-ovulate; style simple and filiform; stigma capitate to 5-lobulate. *Capsules* samaroid, coriaceous, with 5 membranous wings much enlarged laterally, 3- to 5-celled, generally monospermous; seeds large, oblong-fusiform, the testa striate-rimose, surrounded by a weak pulp; cotyledons thick and contortuplicate.

A genus of only three species distributed from Panama to Peru; only one species occurs in Panama.

1. Cavanillesia platanifolia (Humb. & Bonpl.) H. B. K., Nov. Gen. Sp. Pl. **5:** 306. 1823; Standley, Contr. U. S. Nat. Herb. **27:** *pl. 48.* 1928.—Fig. 6.

Pourretia platanifolia Humb. & Bonpl., Pl. Aequin. **2:** 162, *t.133.* 1817.

Tree up to 40-45 m. high, the trunk straight, generally somewhat swollen near the base, attaining 2.40 m. in diam., the crown rather small, loose and more or less rounded, the bark grayish, smooth and porous. *Leaves* grouped toward the tip of the branchlets, the petiole terete, enlarged at the base, 10-25 cm. long; blade ovate-cordate, 3- to 5- to 7-palmatilobate, seldom entire (young leaves?), up to 30 cm. long, the lobes ovate and shortly acuminate, glabrous or nearly so above, more or less densely puberulous and mostly with simple hairs on the lower surface, the nerves prominent especially beneath. *Flowers* precocious, the pedicel ca. 0.7-1.3 cm. long, shortly ferruginous-tomentellous; calyx campanulate, shortly 5-lobate, the lobes triangular and acute, ca 0.9 cm. long and 1 cm. wide, shortly ferruginous-tomentellous outside, silky-villous inside; petals linear-spatulate, long-adnate to the base of the staminal column and appendiculate just above, obtuse and somewhat asymmetric at the apex, ca. 2-2.5 cm. long and 0.6 cm. wide, reddish, ferruginous-tomentellous near the apex especially without; stamens reddish, the staminal column about half as long as the petals, glabrous, the filaments slender, the anthers ca. 1.5 mm. long; ovary subrotund-obovoid, 5-costate, ferruginous-tomentellous, 5-celled; style straight; stigma 5-lobulate. *Capsule* linear-fusiform, acute at both ends, 10-12 cm. long, the wings semicircular, 10-15 cm. high, 5.5-8 cm. wide, membranous and reticulate-veined, 5-celled; seeds large, oblong-linear and acute at both ends.

From Panama to Peru. Colloquial names reported in Panama are *cuipo, quipo, bongo* and *hamati.*

CANAL ZONE: Barro Colorado Island, *Carpenter 48, Kenoyer 640, Standley 40989;* near Gamboa, *Harvey 5272;* Las Cascadas Plantation, near Summit, *Standley 29505;* Red Tank, 4 miles north of Panama, *W. W. & H. E. Rowlee 407.* DARIEN: Marraganti, *R. S. Williams 998;* trail between Pinogana and Yavisa, ca. 15 m., *Allen 296.* PANAMA: around Alhajuela, Chagres Valley, alt. 30-100 m., *Pittier 3474;* Agricultural Experiment Station at Matias Hernández, *Pittier 6957;* Sabana de Dormisolo, near Chepo, alt. 60-80 m., *Pittier 4643.*

7. QUARARIBEA Aubl.

Quararibea Aubl., Hist. Pl. Gui. Fr. 691. 1775

Gerberia Scop., Intr. Hist. Nat. 286. 1777.
Myrodia Sw., Nov. Gen. Sp. Pl. Prodr. 102. 1788.
Matisia Humb. & Bonpl., Pl. Aequin. **1:** 9. 1805.
Lexarza La Llave in La Llave & Lexarza, Nov. Veg. Descript. **2:** 12. 1825.

Trees or shrubs, unarmed. *Leaves* simple, petiolate, the blade generally entire, sometimes cordate at the base, penninerved or palminerved. *Flowers* axillary or oppositifolious, sometimes cauliflorous, solitary or fasciculate, hermaphrodite, actinomorphous, pedicellate, generally (2-)3-bracteolate, the bracteoles caducous or per-

sistent; receptacle eglandular; calyx campanulate or tubiform, irregularly dentate to lobate, sometimes longitudinally winged, coriaceous, lepidote or stellate-pubescent outside, accrescent; petals 5, adnate to the base of the staminal column, fleshy; stamens numerous, the staminal column elongate, undivided to 5-dentate or 5-lobate, the anthers sessile or subsessile near the apex of the staminal column or on the

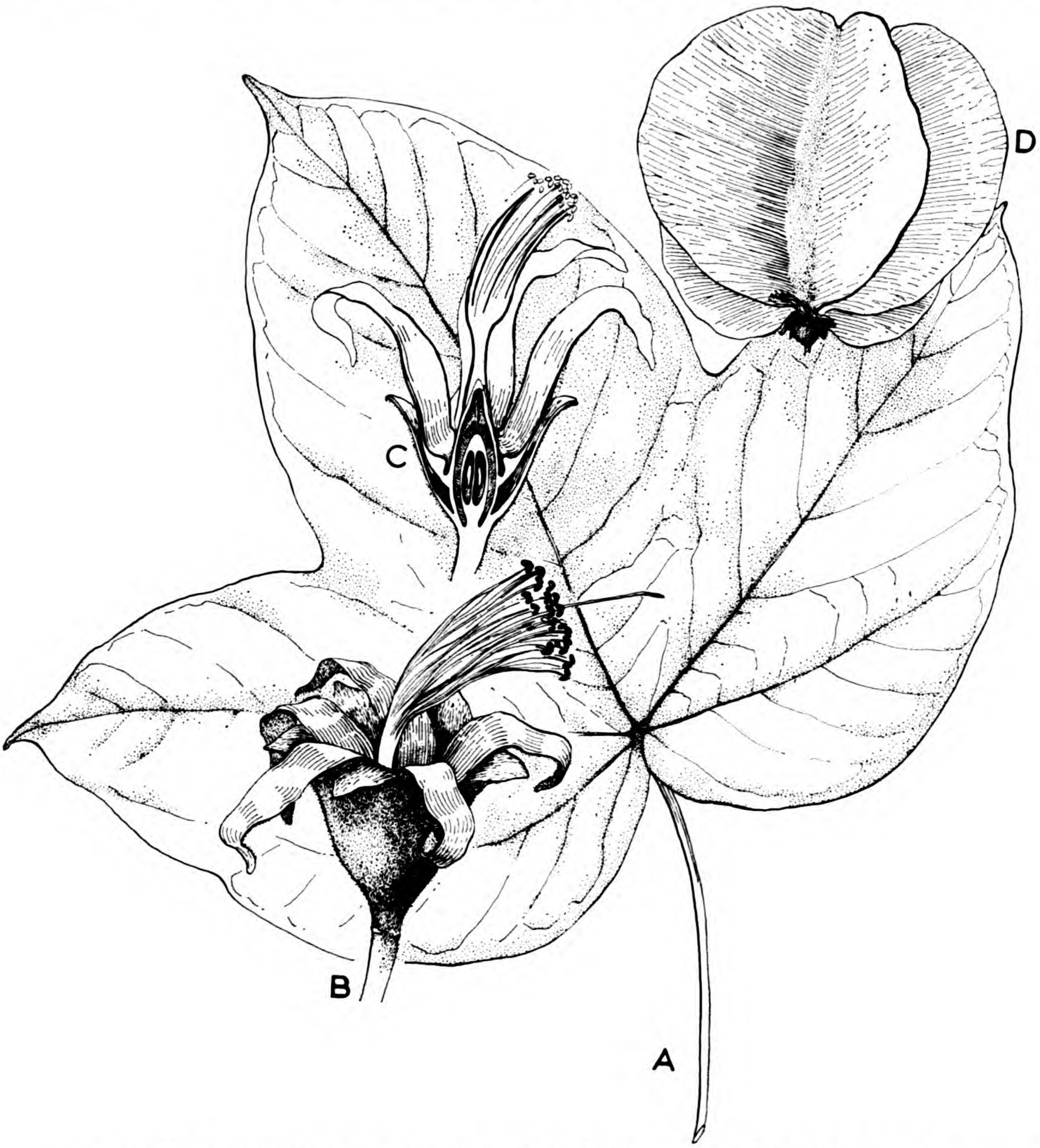

Figure 6. CAVANILLESIA PLATANIFOLIA (Humb. & Bonpl.) H. B. K.: A, leaf, upper surface (× 1/2); B, flower (× 1 1/2); C, id., longitudinal section (× 1 1/2); D, capsule (× 1/4).

lobes, 1-thecate, the thecae paired or not, free or sometimes more or less confluent at the apex, extrorse, longitudinally dehiscent; pollen porate or colporate, the sexine foveolate or ornate-reticulate; ovary subinferior, 2- or 4- or 5-celled, the cells 2-ovulate; style simple; stigma disk-shaped, sometimes shallowly sulcate or lobulate. *Capsules* drupaceous, indehiscent, the mesocarp coriaceous or fleshy-pulpy, 1- to 5-celled; seeds generally 1 in each cell; cotyledons fleshy and contortuplicate.

A neotropical genus of about 75 species of which six are found in Panama. In addition to these six, there are three collections (*Allen 3743, Dunlap 559, Pittier 4353*) "in fruit" which I am presently unable to determine specifically with certainty. Indeed, it is extremely difficult to determine *Quararibea* species when the flowers are lacking, the calyx being accrescent and in many cases changing considerably by the time of fruiting.

Like most contemporary authors, I agree, with Baillon (Adansonia **10:** 146-149. 1871) and Vischer (Bull. Soc. Bot. Genève, ser. 2, **11:** 199-210. 1919), that the genus *Matisia* Humb. & Bonpl. is a synonym of the genus *Quararibea* Aubl., the distinctive generic characters being quite variable (cf. for example, the number of cells in the ovary). Erdtman (Pollen Morphology and Plant Taxonomy, Angiosperms 76. 1952), however, in studying the pollen of about 30 species of the genus *Quararibea* sensu lato, has attracted attention to the fundamental differences between the pollen grains of the genus *Quararibea* (3-porate, sexine foveolate) and of the genus *Matisia* (3-colporate, sexine ornate-reticulate). An exhaustive comparative study both of the morphological characters and of the pollen grains of all the species will be necessary to decide whether *Matisia* should be separated or not.

a. Calyx without longitudinal wings.
  b. Leaves aequilateral; flowers bracteolate.
    c. Leaves oblong-lanceolate, elliptic, oblong-obovate or slightly obovate, penninerved; ovary 2-celled.
      d. Staminal column ca. 1.8-2 cm. long, divided into 5 antheriferous fleshy lobes ca. 2-3 mm. long .... 1. Q. ASTEROLEPIS
      dd. Staminal column ca. 5 cm. long, undivided, the upper part of ca. 7 mm. antheriferous .... 2. Q. PARVIFOLIA
    cc. Leaves cordate-suborbicular or ovate-cordate, 7- to 9-palminerved; ovary 5-celled .... 3. Q. CORDATA
  bb. Leaves oblique and much inaequilateral, 6- to 8-palmate-radiate-nerved; flowers ebracteolate; ovary 5-celled .... 4. Q. OBLIQUIFOLIA
aa. Calyx with 5 or 10 longitudinal wings; flowers bracteolate.
  e. Leaves penninerved; calyx tubiform, 10-winged, 3.5-4 cm. long; petals 9.5-14 cm. long; staminal column 8-13 cm. long; ovary 4-celled; capsule (1-)2-celled .... 5. Q. PTEROCALYX
  ee. Leaves 3- to 5-palminerved; calyx tubiform-conical, 5-winged, 1.2-2 cm. long; petals 2-3 cm. long; staminal column ca. 3.5 cm. long; ovary 5-celled; capsule 5-celled .... 6. Q. BRACTEOLOSA

1. QUARARIBEA ASTEROLEPIS Pittier, Repert. Sp. Nov. **13:** 316. 1914.—Fig. 7.

Quararibea stenophylla Pittier, loc. cit. 317. 114.
Quararibea Chodati Vischer, Bull. Soc. Bot. Genève, ser. 2, **11:** 207, *fig. 1(1), 2(1), 4, 5.* 1919.

Tree 10-25 m. tall, the trunk angular and sometimes buttressed, the crown ovate-rounded or pyramidal, the bark grayish and smooth, the young branchlets fimbrillate-lepidote. *Leaves* with a petiole 1-2.5 cm. long, often slightly arcuate, more or less densely fimbrillate-lepidote; blade oblong-lanceolate to elliptic, sometimes slightly obovate, obtuse or rounded at the base, obtuse or caudate-acuminate at the apex, 7.5-25 cm. long and 3.5-10 cm. wide, subcoriaceous, slightly shining and glabrous to scatteringly fimbrillate-lepidote above, more or less densely

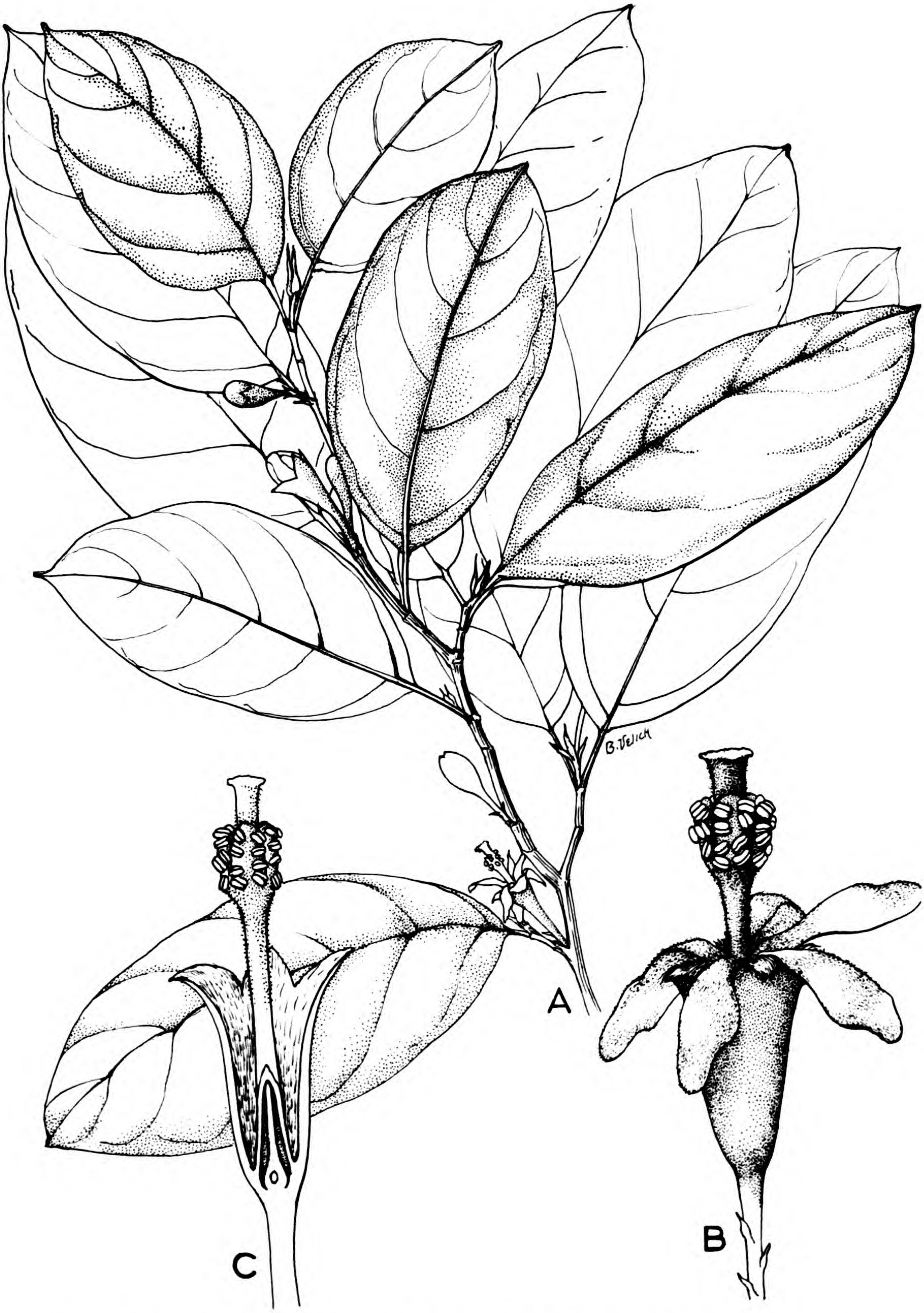

Figure 7. QUARARIBEA ASTEROLEPIS Pittier: A, flowering branch (× ⅔); B, flower (× 2⅔); C, id., longitudinal section, the petals removed (× 2⅔).

fimbrillate-lepidote beneath, seldom glabrous, penninerved, the nerves prominent beneath. *Flowers* mostly oppositifolious, solitary, the pedicel 1-1.5 cm. long and ca. 0.2 cm. wide, densely fimbrillate-lepidote, bracteolate, the bracteoles ca. 1.25-2 mm. long, densely fimbrillate-lepidote, long persistent; calyx campanulate-conical, (3-)4(-5)-lobulate, ca. 1.1-1.4 cm. long and 0.6-1 cm. wide, densely fimbrillate-lepidote without, appressed-sericeous within, the lobes triangular, more or less obtuse and ca. 3-4 mm. long; petals narrowly obovate, acute at the base, asymmetrically emarginate at the apex, 2-2.6 cm. long and 0.5-0.6 cm. wide, whitish, shortly stellate-puberulous on both sides; staminal column cylindric, slightly enlarged near the apex, ca. 1.8-2 cm. long and 0.15 cm. wide, whitish, shortly and densely stellate-puberulous except the base, divided into 5 antheriferous, fleshy lobes ca. 2-3 mm. long, each lobe bearing 8 sessile anthers, the thecae paired, free or confluent at the apex and ca. 1.5 mm. long; ovary pyriform, glabrous, 2-celled; style filiform, slightly enlarged between the antheriferous lobes of the staminal column, up to 2.3 cm. long, densely fimbrillate-lepidote at the base to stellate-tomentellous at the apex; stigma shallowly bilobulate. *Capsule* ovoid to subglobose, mammillate, up to 2 cm. in diam., densely and minutely fimbrillate-lepidote, 1-celled, the fructiferous calyx cupuliform; seeds up to 1.3 cm. long.

Costa Rica and Panama, where it is called *guayabillo.*

CANAL ZONE: Barro Colorado Island, Donato trail, *Shattuck 1082.* DARIEN: headwaters Río Chico, 500-700 ft., *Allen 4632;* Río Chucunaque between El Real and Río Canalones, *Duke 4985;* vicinity of El Real, Río Tuira, trail between El Real and Pinogana, *Stern, Chambers, Dwyer, Ebinger 282;* vicinity of El Real, Río Tuira, 1 mile down from Pinogana near Quebrada Chuito, *Stern, Chambers, Dwyer, Ebinger 118;* vicinity of Campamento Buena Vista, Río Chucunaque above confluence with Río Tuquesa, near Quebrada Felix, *Stern, Chambers, Dwyer, Ebinger 944;* Boca de Pauarandó, on Sambú River, alt. 20 m., *Pittier 5575* (type). PANAMA: near Chepo, *Kluge 58;* vicinity of El Llano, *Duke 5815.*

2. QUARARIBEA PARVIFOLIA Standley, Field Mus. Nat. Hist., Bot. Ser. **4**: 232. 1929.

Tree, small and bushy, the young branchlets shortly stellate-puberulous. *Leaves* shortly petiolate, the petiole 3-8 mm. long, shortly stellate-puberulous or fimbrillate-lepidote, the stipules linear, 3-4 mm. long, shortly stellate-puberulous; blade oblong-lanceolate to obovate-oblong, rounded or obtuse to more or less acute at the base, bluntly acuminate at the apex, 5-19 cm. long and 2-6 cm. wide, membranous, the margins entire to slightly undulate, the upper surface slightly shining and glabrous or nearly so, the lower surface scatteringly fimbrillate-lepidote along the nerves, the nervation penninerved and prominent beneath. *Flowers* axillary, solitary, the pedicel slender, 0.6-4 cm. long, fimbrillate-lepidote, bracteolate, the bracteoles lanceolate-subulate, ca. 4-6 mm. long, fimbrillate-lepidote outside, long persistent; calyx tubiform-conical, 5-lobulate, ca. 14-15 mm. long and 4-5 mm. broad, fimbrillate-lepidote without, appressed-villous within, the lobes rounded and ca. 2 mm. long; petals more or less twice as long as the calyx, white, stellate-arachnoid without, glabrous within; staminal column cylindric, ca. 5 cm. long, undivided, the upper part of ca. 7 mm. antheriferous, glabrous; anthers numerous, sessile; ovary more or less pyriform, ca. 1.5 mm. long

and 1.5 mm. in diam. at the base, sericeous, 2-celled(?); style sericeous near the base, elsewhere glabrous. *Capsule* unknown.

A still imperfectly understood species, known only from the Province Limon in Costa Rica and from the Province Bocas del Toro in Panama.

BOCAS DEL TORO: Changuinola Valley, *Cooper & Slater 99.*

3. QUARARIBEA CORDATA (Humb. & Bonpl.) Vischer, Bull. Soc. Bot. Genève, ser. 2, **11:** 206, *fig. 1(7), 2(3), 3(4).* 1919

Matisia cordata Humb. & Bonpl., Pl. Aequin. **1:** 10, *pl. 2a-2b.* 1805.

Tree up to 30 m. high, the trunk straight and cylindric, the branches horizontal, the bark cinereous and rugose. *Leaves* long-petiolate, the petiole terete, slightly enlarged at both ends, 7.5-20 cm. long and ca. 2.5-4 mm. thick, glabrous or nearly so; blade cordate-suborbicular or ovate-cordate, 18-21 cm. long and 13-24 cm. wide, chartaceous to subcoriaceous, glabrous or nearly so above, glabrous to shortly stellate-puberulous beneath, 7- to 9-palminerved, the nervation prominent beneath. *Flowers* 3- to 9-fasciculate on the branches, the pedicel terete, 2- or 3-bracteolate; calyx irregularly 2- to 5-lobate, shortly stellate-tomentellous without, appressed-sericeous within, the lobes ovate and acute; petals obovate-oblong, cuneate at the base, rounded at the apex, about half again as long as the calyx, 2 petals a little smaller than the other 3, pale pink; staminal column longer than the petals, 5-lobate, the antheriferous lobes about ⅓ of the length of the staminal column, each lobe bearing about 12 anthers; ovary 5-celled; style filiform, 5-angular at the base, shorter than the stamens, puberulous; stigma peltate-capitate. *Capsule* leathery, globose, mammillate, ca. 7.5 cm. long and 6-6.5 cm. in diam., shortly appressed-tomentellous, 2- to 5-celled, 2- to 5-seeded, the fructiferous calyx cupuliform, ca. 2.5 cm. long and 4.5 cm. in diam.; seeds up to 5 cm. long, 2 cm. wide and 1.8 cm. thick.

Panama and northwestern South America (Colombia to Peru); the *sapote* is sometimes cultivated for its edible fruits.

COCLÉ: region north of El Valle de Antón, 1,000 m., *Allen 3729.* DARIEN: Río Pirre, ca. 10 mi. south of El Real, *Duke 5471.*

4. QUARARIBEA OBLIQUIFOLIA (Standley) Standley, Field Mus. Nat. Hist., Bot. Ser. **18:** 683. 1937.

Matisia obliquifolia Standley, loc. cit. **4:** 232. 1929.
Matisia asymmetrica Cuatr., Rev. Acad. Colomb. Cienc. **7:** 49. 1946.
Quararibea asymmetrica (Cuatr.) Cuatr., Lloydia **11:** 191. 1948.

Tree 12-15 m. high, the trunk 20-25 cm. in diam., the pubescence of stellate hairs, the young branchlets puberulous to tomentellous. *Leaves* long-petiolate, the petiole slender, subterete, 3.5-7 cm. long, puberulous; blade oblique-obovate to oblique-elliptic, much inaequilateral and cordate at the base, obtuse or rounded at the apex, 17-30 cm. long and 8-23 cm. wide, subcoriaceous, the margins slightly

and irregularly undulate, the upper surface glabrous or scatteringly puberulous along the nerves, the lower surface sparsely puberulous, 6- to 8-palmate-radiate-nerved, the nervation reticulate and prominent beneath. *Flowers* cauliflorous, fasciculate, the pedicel slender, 0.8-2 cm. long, sparsely and shortly puberulous, ebracteolate; calyx campanulate, 5-lobulate, 12-15 mm. long and ca. 9 mm. broad, sparsely and shortly puberulous without, appressed-sericeous within, the lobes more or less triangular, obtuse and ca. 3 mm. long; petals obovate or elliptic, abruptly unguiculate, obtuse or rounded or seldom emarginate at the apex, 15-20 mm. long and 9-10 mm. wide, white, glabrous at the base to tomentellous on the upper part outside, glabrous inside; staminal column ca. 4 cm. long, white, glabrous, divided into 5 antheriferous lobes 10-15 mm. long, each lobe bearing 6 sessile anthers; ovary shortly tomentellous, 5-celled; style somewhat longer than the staminal column, puberulous; stigma capitate and briefly lobulate. *Capsule* ovoid or subglobose, subcoriaceous, up to 4 cm. in diam., shortly puberulous, 5-celled, each cell 1-seeded.

Costa Rica, Panama and Colombia. This species is very closely related to the 3 following species: *Q inaequalis* (Dugand) Garcia-Barriga & Hernandez (*Matisia inaequalis* Dugand, Caldasia **3**: 359. 1945), *Q. inaequilatera* Cuatr. (Lloydia **11**: 187. 1948), and *Q. Uribei* Garcia-Barriga & Hernandez (Mutisia **2**: 1. 1952), and, when more material is available for study, all these species may perhaps be reduced to synonymy!

BOCAS DEL TORO: region of Almirante, Daytonia Farm, *Cooper 435* (type).

5. QUARARIBEA PTEROCALYX Hemsl., Diagn. Pl. Nov. Mex. Centr.-Am. 4. 1878, Biol. Centr.Am. **1**: 127, *t.10*. 1879; Standley, Jour. Arnold Arb. **11**: 124. 1930.

Tree 6.5-13 m. tall, the trunk up to 22 cm. in diam., the pubescence of stellate hairs (sometimes of tufted hairs?), the young branchlets whitish-gray-tomentellous to puberulous. *Leaves* with a terete petiole 1.5-2.5 cm. long, often slightly geniculate near the middle, tomentellous especially when young; blade elliptic to ovate-elliptic, rounded and sometimes unequal at the base, rounded or caudate-obtuse or long-acuminate at the apex, 14-30 cm. long and 6-13.5 cm. wide, subcoriaceous, the margins sometimes slightly recurved, bright and glabrous or nearly so above, whitish-gray-tomentellous beneath, penninerved, the nerves prominent beneath. *Flowers* axillary or oppositifolious, solitary, the pedicel short, narrowly 10-winged, ca. 1-1.3 cm. long, shortly tomentellous, bracteolate, the bracteoles ca. 2.5 mm. long, shortly tomentellous, long persistent; calyx tubiform, longitudinally 10-winged, 3-lobate, 3.5-4 cm. long and ca. 1.2 cm. wide, shortly tomentellous without, appressed-sericeous within, the lobes irregular, obtuse to rounded and ca. 1 cm. long; petals linear-spatulate, emarginate, 9.5-14 cm. long and 1.2-1.4 cm. wide, white, sparsely puberulous on both sides; staminal column cylindric, somewhat 5-angular, slightly enlarged and shortly 5-dentate at the apex, 8-13 cm. long and ca. 0.3 cm. wide, shortly tomentellous except the base, the upper part of ca. 2 cm. antheriferous; anthers numerous, subsessile, the thecae paired, free and parallel or more or less confluent at the apex, ca. 1.5 mm. long;

ovary narrowly pyriform, ca. 5 mm. long and 3 mm. in diam. at the base, shortly tomentellous, 4-celled; style filiform, slightly enlarged near the apex, as long as the staminal column, shortly tomentellous; stigma disk-shaped, ca. 4 mm. in diam. *Capsule* subglobose, mammillate, ca. 3.2-3.8 cm. long and 3.6-4.5 cm. in diam., tomentellous, (1-)2-celled, each cell 1-seeded, the fructiferous calyx cupuliform and ca. 4-5 cm. in diam.; seeds 2-2.6 cm. long.

Panama, in forests in swampy ground.

CANAL ZONE: Barro Colorado Island, *Aviles X7, Bangham 581, Shattuck 1018;* Frijoles Station, *Hayes 137* (type); along the Trinidad River, near sea level, *Pittier 4010.* DARIEN: 1-3 mi. southeast of Santa Fe on Pan-Am. Highway, *Duke 4100;* 0-4 mi. up Río Sabana from Santa Fe, *Duke 4174, 4175;* headwaters Río Chico, 500-750 ft., *Allen 4631;* vicinity of Paya, Río Paya and Palo de las Letras, *Stern, Chambers, Dwyer, Ebinger 212;* El Real, *Duke 4843.* PANAMA: Tocumen, *Dwyer 4192;* Chepo, *Kluge 53;* vicinity of Arenoso, lower Río Trinidad, 26-50 m., *Seibert 595.*

6. QUARARIBEA BRACTEOLOSA (Ducke) Cuatr., Lloydia **11**: 191. 1948.

Matisia bracteolosa Ducke, Bol. Tecn. Inst. Agron. Norte, Belem **4**: 17. 1945.
Quararibea Schultesii Cuatr., Bot. Mus. Leafl., Harv. Univ. **14**: 31. 1949.
Matisia Schultesii (Cuatr.) Cuatr., Phytologia **4**: 479. 1954.

Shrub to medium-sized tree up to 15 m. high, the pubescence chiefly of stellate hairs, the young branchlets densely ferruginous-puberulous. *Leaves* with a petiole 1-3 cm. long, densely ferruginous-puberulous, the stipules lanceolate, ca. 9 mm. long and 2.5 mm. wide, densely puberulous; blade oblong-obovate, seldom obovate, rounded to cuneate or sometimes obtuse at the base, acute to acuminate at the apex, 10-32 cm. long and 4.5-15 cm. wide, membranous, the upper surface sparsely puberulous and with simple and stellate hairs, the lower surface more or less densely puberulous and with chiefly stellate hairs, 3- to 5-palminerved at the base, the nervation reticulate and prominent beneath. *Flowers* oppositifolious, solitary, the pedicel flexuose, 1.2-2 cm. long (the fructiferous pedicel up to 5 cm. long), tomentellous, the bracteoles inserted just below the calyx, lanceolate to broadly lanceolate, ca. 1-1.5 cm. long and 0.2-0.8 cm. wide, tomentellous, rather long persistent; calyx tubiform-conical, 5-lobulate, provided with 5 longitudinal, well-developed, membranous wings, 1.2-2 cm. long, tomentellous without, appressed-whitish-sericeous within; petals narrowly spatulate, long-unguiculate, rounded and reflexed or spreading at the apex, 2-3 cm. long and 0.5-0.8 cm. wide, white, glabrous on the lower half to tomentellous on the upper half outside, glabrous inside; staminal column cylindric, ca. 3.5 cm. long, glabrous, divided into 5 antheriferous lobes ca. 0.4-0.8 cm. long, each lobe bearing 6 sessile anthers, the thecae free and ca. 1.5 mm. long; ovary transverse-elliptic, ca. 2-2.5 mm. long and 3 mm. in diam., shortly tomentellous, 5-celled; style more or less as long as the staminal column or somewhat longer, puberulous; stigma capitate. *Capsule* surrounded by the much accrescent calyx, ovoid, 2.5-4 cm. long and 1.7-2 cm. in diam., shortly puberulous, 5-celled, the cells 1-seeded, the fructiferous calyx cupuliform, 1.6-2.3 cm. long and 2-2.5 cm. broad; seeds oblong, 1.1-1.8 cm. long and ca. 0.4-0.5 cm. broad.

From Panama to Peru and Amazonian Brazil, along rivers.

BOCAS DEL TORO: region of Almirante, Daytonia Farm, *Cooper 452*. DARIEN: Caná-Cuasi trail (Camp 2), Chepigana District, 2,000 ft., *M. E. & R. A. Terry 1447*; Río Tucuti, on ridge upstream ca. 2 hrs. piragua above Tucuti, *Duke 5258*. PROVINCE UNKNOWN: *M. E. Terry s. n.*

8. HAMPEA Schlecht.

HAMPEA Schlecht., Linnaea **11**: 371. 1837.

Shrubs or trees, unarmed. *Leaves* simple, petiolate, the stipules narrowly linear, the blade entire or lobate, sometimes auriculate-appendaged at the base, palminerved. *Inflorescences* axillary, fasciculate or flowers solitary. *Flowers* hermaphrodite or imperfect, pubescent and generally with tufted hairs, pedicellate, 3-bracteolate, the bractlets adnate to the calyx and caducous; receptacle eglandular; calyx cupuliform or campanulate, truncate or lobate, coriaceous, accrescent; petals 5, connate at the base into a tube coalescent with the staminal column, fleshy; stamens numerous, the staminal column divided into many unequal filaments; anthers 1-thecate, hippocrepiform, medifixus, extrorse, longitudinally dehiscent; pollen porate, the sexine uniform, tegillate and spinulate; ovary superior, sessile, 3-celled, none or rudimentar in the staminate flowers, the cells few-ovulate; style simple; stigma 1- to 3-divided and revolute. *Capsules* coriaceous or subligneous, loculicidally 3-valvate, the valves glabrous or not within; seeds few, the funicle expanded into a fleshy aril; cotyledons fleshy and contortuplicate.

A genus of about 15 species of Central America and Colombia; one species occurs in Panama.

1. HAMPEA APPENDICULATA (J. D. Sm.) Standley, Jour. Wash. Acad. Sci. **17**: 395. 1927.—Fig. 8

Hampea integerrima Schlecht. var. *appendiculata* J. D. Sm., Bot. Gaz. **27**: 331. 1899.
Hampea panamensis Standley, Jour. Wash. Acad. Sci. **17**: 396. 1927, Jour. Arnold Arb. **11**: 124. 1930.

Shrub or medium-sized tree up to 15 m. tall, the young branches covered with a short tomentum of ferruginous or ochraceous, tufted hairs. *Leaves* with tufted hairs, the petiole slender, 1.2-11 cm. long, shortly tomentellous; blade ovate to broadly ovate, sometimes more or less elliptic, truncate to subcordate or sometimes obtuse and auriculate-appendaged at the base, the appendages rounded and ca. 1-4 mm. long, acuminate to caudate-acuminate at the apex, 9-21 cm. long and 6-16 cm. wide, the margins entire or somewhat undulate, sparsely and shortly puberulous above especially when young, generally shortly tomentellous beneath, 5- to 7-palminerved, the nerves prominent beneath. *Flowers* solitary or fasciculate, either hermaphrodite or staminate, the pedicel of the staminate flowers 0.5-1.5 cm. long, that of the hermaphrodite ones usually longer and to 2-5 cm. long, slender, covered with a short tomentum of tufted hairs; bracteoles liguliform, 0.3-2 cm. long and ca. 1 mm. wide, tomentellous; calyx cupuliform-campanulate, irregularly 3- to 4-lobate, 7-9 mm. long and 9-12 mm. wide, covered with a short tomentum of tufted hairs without, glabrous within; petals 16-18 mm. long, white, creamy white or yellow, the corolla-tube ca. 3-4 mm. long and glabrous, the lobes obliquely and in-

Figure 8. HAMPEA APPENDICULATA (J. D. Sm.) Standley: A flowering branch (× ⅔); B. staminate flower (× 2); C, id., longitudinal section (× 2); D & E, capsules (× ⅔).

aequilaterally elliptic, unguiculate, emarginate and unilaterally apiculate at the apex, 13-14 mm. long and ca. 8 mm. wide, tomentellous outside, glabrous or nearly so and glandular-dotted within; stamens more numerous in the staminate flowers than in the hermaphrodite ones, about 22-40, the staminal column ca. 3-4 mm. long, barbate at the apex, not hollow in the staminate flowers, the filaments slender, unequal, 8-10 mm. long and glabrous; ovary more or less oblong, ca. 2 mm. long and 1.25 mm. in diam., densely papillate; style filiform; stigma slightly 3-divided. *Capsule* subligneous, very shortly stipitate, ellipsoid, 3-angular, subapiculate to rounded at the apex, 1.7-2.5 cm. long and 1.1-1.2 cm. in diam., covered with a short tomentum of tufted hairs outside, glabrous within except along the hispid sutures; seeds 1 or 2 in each cell, ellipsoid, 7-10 mm. long and 4.5-6 mm. wide, the testa blackish-brown with paler nerves, the aril caplike, covering less than half of the seed.

Costa Rica and Panama.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 227;* Almirante region, *Cooper & Slater 8, 15* (type); region of Almirante, Buena Vista Camp on Chiriquí trail at 3,000 ft., *Cooper 599;* Water Valley, *von Wedel 779;* vicinity of Chiriquí Lagoon, *von Wedel 1315;* Río Cricamola, between Finca St. Louis and Konkintoë, ca. 10-50 m., *Woodson, Allen & Seibert 1898, 1922.* CANAL ZONE: Barro Colorado Island, *Aviles 11, Bangham 520, Salvoza 935, 985, Shattuck 238.* CHIRIQUÍ: Quebrada Velo, vicinity Finca Lerida, alt. 5,000 ft., *Allen 4670;* Bajo Mono-Robalo trail, Western slopes of Cerro Horqueta, alt. 5,000-7,000 ft., *Allen 4779;* Boquete region, Cerro Horqueta-cloud forest, alt. 6,500 ft., *Ch. & W. von Hagen 2138.* COCLÉ: north rim of El Valle, *Allen 1908;* El Valle, *Dwyer 1924.*

9. OCHROMA Sw.

OCHROMA Sw., Nov. Gen. Sp. Pl. Prodr. 97. 1788.

Trees, unarmed, the trunk sometimes buttressed, the wood very light. *Leaves* simple, petiolate, the stipules broadly ovate, the blade generally cordate, palminerved, with tufted hairs. *Flowers* grouped toward the tip of the branchlets, axillary, solitary, hermaphrodite, actinomorphous, pedicellate, 3-bracteolate, the bracteoles fugacious; receptacle eglandular; calyx tubiform, slightly funnel-shaped, 5-lobate and with unequal lobes, coriaceous, with tufted hairs outside, deciduous; petals 5, adnate to the base of the staminal column, fleshy, with tufted hairs outside; stamens numerous, the staminal column elongate, shortly 5-lobate, antheriferous from about the middle to the apex; anthers 1-thecate, sessile, confluent, anfractuose, extrorse, longitudinally dehiscent; ovary superior, sessile, 5-celled, the cells many-ovulate; style filiform; stigma exceeding slightly the staminal column, spirally 5-sulcate. *Capsules* subligneous, elongate, loculicidally 5-valvate, densely lanate within; seeds numerous, small, pyriform, imbedded in the hairs of the capsule; cotyledons broad, the margins involute.

A neotropical, monotypic genus distributed from southern Mexico to Bolivia.

1. OCHROMA PYRAMIDALE (Cav. ex Lam.) Urban, Repert. Sp. Nov. Beih. **5:** 123. 1920.—Fig.9.

Bombax pyramidale Cav. ex Lam., Encycl. Méth. Bot. **2:** 552. Apr. 1788.
Ochroma lagopus Sw., Nov. Gen. Sp. Pl. Prodr. 98. Jun.-Jul. 1788.

Figure 9. OCHROMA PYRAMIDALE (Cav. ex. Lam.) Urban: A, flowering branch (× ½); B, flower (× ½); C, id., longitudinal section (× ½); D, dehiscent capsule and kapok (× ½).

Ochroma tomentosa Humb. & Bonpl. ex Willd., Enum. Pl. Hort. Reg. Bot. Berol. 695. 1809.
Bombax angulata Sesse & Moç., Fl. Mex. 169. 1895.
Ochroma concolor Rowlee, Jour. Wash. Acad. Sci. **9:** 161. 1919.
Ochroma limonensis Rowlee, loc. cit. 163. 1919.
Ochroma grandiflora Rowlee, loc. cit. 163. 1919.
Ochroma velutina Rowlee, loc. cit. 164. 1919.
Ochroma bicolor Rowlee, loc. cit. 165. 1919.
Ochroma boliviana Rowlee, loc. cit. 166. 1919.
Ochroma obtusa Rowlee, loc. cit. 166. 1919.
Ochroma peruviana Johnston, Contr. Gray Herb. Harv. Univ. **81:** 95. 1928.
Ochroma pyramidale var. *concolor* (Rowlee) Schultes, Bot. Mus. Leafl., Harv. Univ. **9:** 177. 1941.
Ochroma tomentosa var. *ibarrensis* Benoist, Bull. Soc. Bot. Fr. **88:** 439. 1941.
Ochroma lagopus var. *bicolor* (Rowlee) Standley & Steyerm., Field Mus. Nat. Hist., Bot. Ser. **23:** 62. 1944.
Ochroma lagopus var. *occigranatensis* Cuatr., Phytologia **4:** 480. 1954.
Ochroma pyramidale var. *bicolor* (Rowlee) Brizicky, Trop. Woods **109:** 63. 1958.

Tree 10-30 m. tall, the trunk up to 0.90-1.80 m. in diam., sometimes buttressed, the crown large and spreading, the bark smooth and grayish, the branchlets tufted-puberulous. *Leaves* with a thick petiole 3-40 cm. long, tomentellous to glabrescent, the stipules ca. 1.5 cm. long and 1 cm. wide; blade broadly ovate, ovate-angulate to ovate and 3- to 5-sublobate, the base generally deeply cordate, sometimes more ro less truncate, the apex or the central lobe obtuse, acute or acuminate, 10-40 cm. long and 11-35 cm. wide, chartaceous, the margins generally undulate, the upper surface tomentellous especially when young to glabrous, the lower surface shortly tomentellous, 7(-9)-palminerved, the nervation prominent beneath. *Flowers* with a pedicel 4-11 cm. long and ca. 0.6-1 cm. in diam., tomentellous; calyx 8-11.5 cm. long, tomentellous outside, sericeous-villous inside, the lobes 2.5-4 cm. long, 2 lobes triangular and acute, the other 3 flabelliform; petals obovate-spatulate, 11-15 cm. long and ca. 5 cm. wide, whitish, puberulous on the upper part outside, glabrous or nearly so inside; staminal column cylindric, enlarged at the base, 10-12.5 cm. long, glabrous, the antheriferous part ca. 5-5.5 cm. long; ovary conical, 5-angulate, ca. 13 mm. long and 7 mm. in diam. at the base, tomentellous at the apex; style ca. 9-10 cm. long, puberulous near the base; stigma ca. 3.5 cm. long. *Capsule* oblong-fusiform, 5-angulate, 16-25 cm. long and ca. 2.5 cm. in diam., the valves black and glabrous; seeds ca. 5 mm. long; kapok pale brown.

Frequent in clearings and second-growth forests; often cultivated, sometimes planted for shade.

Balsa is a rapidly growing tree known for its very lightweight wood which is used for life rafts, insulating, toys, etc.; the kapok is suitable for filling pillows and mattresses.

BOCAS DEL TORO: Changuinola Valley, *Cooper & Slater 77;* locality unknown, *von Wedel 459.* CANAL ZONE: vicinity of Fort Sherman, *Standley 31015;* near Fort Randolph, *Standley 28733;* Gatun Station, *Hayes 123;* Barro Colorado Island, *Aviles 44, L. H. & E. Z. Bailey 151, Bangham 531, Kenoyer 441, Shattuck 526, Wetmore & Abbe 47;* Gamboa, *Standley 28497;* Obispo, *Standley 31711;* between Summit and Gamboa, *J. M. & M. T. Greenman 5219;* vicinity of Miraflores, *P. & G. White 41;* between Miraflores and Corozal, alt. 20-30 m., *Pittier 2511;* Ancon Hill, *Bro. Celestine 119, Rowlee & Stork 802;* Balboa, *Standley 26976;*

road K9, alt. 270 ft., *Stern & Chambers 42;* Chiva-Chiva road, *Harvey 5254;* locality unknown, *Verner s. n.* CHIRIQUÍ: Progresso, *Cooper & Slater* 253. COLÓN: Juan Mina, Río Chagres, 25 m., *Allen 4201.* DARIEN: vicinity of Pinogana, 20 m., *Allen 4312.* PANAMA: Bella Vista, *Macbride 2761;* Capiri River, west of Panama City, *Baker 804;* along road between Panama and Chepo, *Dodge, Hunter, Steyermark & Allen 16633;* Taboga Island, *Standley 28006;* San José Island, *Johnston 470, 511.* VERAGUAS: vicinity of Santa Fe, Río Santa Maria, 1,000 ft., *Allen 4421.* PROVINCE UNKNOWN: *W. W. & H. E. Rowlee 4, R. S. Williams 607.*

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FLORA OF PANAMA[1]

Part VI

Family 117. STERCULIACEAE[2]

By ANDRÉ ROBYNS[3]

Theobroma By JOSÉ CUATRECASAS

Herbs, shrubs or trees, sometimes lianas, mucilaginous, generally with stellate hairs, sometimes with simple hairs or lepidote, infrequently aculeate. *Leaves* alternate, rarely subopposite, simple and entire to lobate or digitately compound, generally stipulate, the stipules usually deciduous. *Inflorescences* axillary or sometimes terminal, cymose, paniculate, umbelliform, racemose or often more complex, or flowers solitary, sometimes cauliflorous. *Flowers* generally bracteolate, the bracteoles forming sometimes a calycle, rather small, hermaphrodite or unisexual, actinomorphous or rarely zygomorphous; calyx valvate, gamo- or polysepalous, the sepals (2-3-)4-5(-6-8), sometimes petaloid, generally persistent or even accrescent; petals usually 5, rarely absent, contorted or valvate, usually free, sometimes adnate to the base of the staminal tube, often unguiculate at the base and appendaged at the apex, sometimes marcescent; stamens inserted on the receptacle or on a gonophore, 5 to numerous, usually more or less long-monadelphous, often with staminodes alternating with the stamens or with fascicles of stamens; anthers usually 2-thecate, rarely 3-thecate, the thecae generally parallel, the dehiscence longitudinal or occasionally apically porose; pollen generally 3-colporate, sometimes colpate, porate or oligoforate, the sexine usually reticulate, sometimes spinulose; gynoecium with 2-5(-15-30) syncarpous or coherent or even sometimes apocarpous carpels, or reduced to a single carpel; ovary superior, sessile on the receptacle or on the gonophore, or sometimes slightly stipitate, 1- to 5(-15-30)-celled, with 2-many ovules in each cell and generally with axile placentation; ovules anatropous; styles as many as carpels, distinct or variously connate; stigma entire or divided. *Fruit* capsular or baccate and loculicidally dehiscent or not, or separating into follicles, cocci or samaroid indehiscent mericarps; seeds 1-many, sometimes alate or arillate; albumen abundant or scanty; embryo straight or curved; cotyledons flat or folded, foliaceous.

About 65 genera, chiefly distributed in the tropics of both hemispheres; eight genera are represented in Panama, while three other genera occur in Central

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1. The Flora of Panama by Robert E. Woodson, Jr. and Robert W. Schery and Collaborators should be cited as: Ann. Missouri Bot. Gard., with volume number, pagination and date of the Annals.

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America. Two of the most important tropical crops are supplied by *Theobroma Cacao* L. (cacao, chocolate) native to tropical America but now grown extensively in all the tropics and by different species of the genus *Cola* Schott & Endl. (Cola Nut Trees) native to tropical Africa.

a. Petals none; gonophore well developed .... 1. STERCULIA
aa. Petals 5.
  b. Staminodes none; gonophore wanting.
    c. Ovary 1-celled; capsules 2-valved .... 2. WALTHERIA
    cc. Ovary 5-celled; capsules separating into 5 cocci, each coccus opening along the inner angle or splitting completely into 2 valves .... 3. MELOCHIA
  bb. Staminodes 5.
    d. Gonophore well developed; fruit spirally twisted .... 4. HELICTERES
    dd. Gonophore wanting.
      e. Fruit smooth, rugose or 5- to 10-costate.
        f. Leaves simple .... 5. THEOBROMA
        ff. Leaves compound-digitate .... 6. HERRANIA
      ee. Fruit spinose or muricate.
        g. Aculeate scandent shrubs or lianas; capsules densely spinose, separating into 5 cocci, each coccus dehiscent along the ventral suture and along the dorsal upper half. .... 7. BYTTNERIA
        gg. Small to tall trees without aculei; capsules tuberculate, indehiscent (the tubercles separating irregularly at maturity to a greater or less degree) .... 8. GUAZUMA

1. STERCULIA L.

STERCULIA L., Sp. Pl. 1007. 1753, Gen. Pl. ed. 5, 438. 1754.

Cavalam Adans., Fam. Pl. **2:** 357. 1763.
Culhamia Forsk., Fl. Aegypt.-Arab. 96. 1775.
Ivira Aubl., Hist. Pl. Gui. Fr. 694. 1775.
Theodoria Neck., Elem. Bot. **2:** 286. 1790.
Triphaca Loureiro, Fl. Cochinch. 577. 1790.
Southwellia Salisb., Paradisus Londinensis *t.69.* 1807.
Mateatia Vell., Fl. Flum. 382. 1825, Fl. Flum. Ic. **9:** *t.95.* 1835.
Chichaea Presl, Rel. Haenk. **2:** 140. 1835.
Balanghas Rafin., Sylva Tellur. 72. 1838.
Kavalama Rafin., loc. cit. 72. 1838.
Karaka Rafin., loc. cit. 72. 1838.
Braxipis Rafin., loc. cit. 72. 1838.
Clompanus Rafin., loc. cit. 73. 1838.
Opsopea Rafin., loc. cit. 73. 1838.
Icosinia Rafin., loc. cit. 75. 1838.
Triplobus Rafin., loc. cit. 110. 1838.
Carpophyllium Miq., Fl. Ind. Bat. Suppl. 401. 1861.

Trees or infrequently shrubs, deciduous. *Leaves* alternate, simple and entire to lobate or digitately compound, petiolate, stipulate, the stipules fugacious. *Inflorescences* axillary or terminal, paniculate or sometimes racemose. *Flowers* hermaphrodite or unisexual, monoecious or dioecious, actinomorphous or somewhat zygomorphous through the bending of the gonophore, pedicellate, bracteolate, the bracts fugacious; calyx more or less deeply (3-)4- or 5(-6)-lobate, the lobes sometimes appendiculate inside; petals none; gonophore well developed; stamens 10-20, only vestigial in the pistillate flowers, the anthers crowded at the apex of

a short staminal tube, shortly stipitate, 2-thecate, the thecae parallel, extrorse, longitudinally dehiscent; ovary sessile, consisting of (3-)4-5 coherent locules, rudimentary in the staminate flowers, each locule 2- to many-ovulate; styles coherent; stigma (3-)4- or 5-lobulate or peltate. *Carpels* separating at maturity and becoming follicular, ligneous or coriaceous, dehiscent along the ventral suture, 1- to many-seeded; seeds albuminous, the radicle removed from the hilum; cotyledons thin, plane or undulate.

A pantropical genus of about 200 species of which only two occur in Panama.

a. Leaves deeply 3- to 5-palmatilobate; calyx 1.5-2 cm. long, the lobes triangular, not appendiculate inside; gonophore not enlarged at the base, 10-12 mm. long in the staminate flowers and 6-8 mm. long in the hermaphrodite ones; anthers 15 .... 1. S. APETALA

aa. Leaves entire or with slightly undulate margins; calyx 0.9-1.2 cm. long, the lobes linear-lanceolate, the inner surface appendiculate from the base to the middle of the lobes; gonophore much-enlarged at the base, 5.5-6 mm. long in the staminate flowers and ca. 5 mm. long in the hermaphrodite ones; anthers 10 .... 2. S. COSTARICANA

1. STERCULIA APETALA (Jacq.) Karst., Fl. Colomb. **2:** 35, *pl. 118.* 1869; Standley, Contr. U. S. Nat. Herb. **27:** *pl. 49, 50.* 1928.—Fig. 1 (A-E).

Helicteres apetala Jacq., Select. Stirp. Am. Hist. 238, *pl. 181.* 1763.
Sterculia carthagenensis Cav., Mon. Cl. Diss. Dec. **6:** 353. 1788.

Tree up to 30-40 m. high, the trunk straight, thick and often with prominently developed buttresses, the crown broad and dense. *Leaves* simple, large, the petiole 8-24 cm. long, stellate-villous, the blade deeply 3- to 5-palmatilobate, the broad lobes rounded to subacute, deeply cordate at the base, up to 22 cm. long and 40 cm. wide, membranous, the upper surface glabrous except near the base of the 5 main nerves, the lower surface stellate-arachnoid when young, promptly glabrescent, the nerves slightly prominent beneath. *Inflorescences* axillary or subterminal, paniculate, the axes densely stellate-villous-arachnoid. *Flowers* hermaphrodite or staminate, the pedicel 1-2 cm. long; calyx campanulate, 5-lobate, 1.5-2 cm. long and 1.5-2.5 cm. wide, often somewhat larger in the hermaphrodite flowers than in the staminate ones, the lobes triangular, acute and ca. 0.7-1.2 cm. long, reddish-brown, densely puberulous and with tufted hairs outside, greenish-yellow, striped-red or maroon and glabrous inside; gonophore of the staminate flowers slender, arcuate, inflexed, ca. 1-1.2 cm. long, scatteringly papillate, sometimes loosely stellate-puberulous toward the base, the staminal tube pendulous, somewhat thicker than the gonophore, ca. 1 mm. long and densely covered with short simple hairs, the anthers 15, ca. 0.75 mm. long, the rudimentar ovary ca. 0.75 mm. broad and glabrous; gonophore of the hermaphrodite flowers like in the staminate ones but only 6-8 mm. long, the staminal tube very short, the anthers 15, around the base of the ovary and ca. 0.75 mm. long, the ovary subglobose, 5-sulcate, ca. 0.4 mm. in diam., stellate-tomentellous, 5-locular, the styles reflexed, ca. 4 mm. long and stellate-tomentellous, the stigma obscurely 5-lobulate. *Follicles* obovoid, ca. 6 cm. long and 4 cm. thick, tomentellous outside, the inner surface covered with a dense layer of erect, stiff, yellowish and ca. 2 mm. long prickly hairs, 2- to 4-seeded;

seeds oblong-ellipsoid, ca. 2 cm. long and 1.1-1.3 cm. in diam., the testa brown or black, covered with stiff, little adhesive, prickly hairs.

From southern Mexico through Central America to Panama, West Indies and northern South America; along rivers, in moist or dry thickets or forests.

The common Indian name of *S. apetala* is *panamá* and the name of the country proceeds probably from this tree which is abundant in the region. The seeds, known as *castañas*, are oily and edible boiled or roasted; the tree is often planted for shade and the wood is sometimes used for construction purposes.

CANAL ZONE: Barro Colorado Island, *Aviles 101, Wetmore & Abbe 114, Wilson 97, Woodworth & Vestal 651;* Gamboa Road and Madden Dam Road near Naval Station, *Harvey 5034;* near Summit Gardens, *Harvey 5252;* Victoria Fill, near Miraflores Locks, *Allen 1720;* vicinity of Miraflores Lake, *P. White 281;* Balboa, *Standley 27160, 30856.* CHIRIQUÍ: Progresso, *Cooper & Slater 301;* vicinity of San Félix, alt. 100 m., *Allen 3656.* PANAMA: roadside near Panama Viejo, 5-10 m., *Dodge 17520,* near Panama City, *Mell s.n.;* vicinity of Bella Vista, *Piper 5327.* SAN BLAS: Permé, *Cooper 652.* PROVINCE UNKNOWN: *Hayes 719, Sargent 15.*

2. STERCULIA COSTARICANA Pittier, Contr. U. S. Nat. Herb. **13:** 449, *fig.* 77-78. 1911. —Fig. 1 (F-H).

Sterculia Recordiana Standley, Trop. Woods **44:** 25. 1935.

Tree 5-25 m. high, the trunk up to 90 cm. in diam., the young branches tomentellous and sparsely pilose, the pubescence of stellate hairs. *Leaves* crowded toward the end of the branchlets, simple, the petiole rounded, 2.5-7 cm. long, tomentellous and sparsely pilose, the blade ovate-oblong to elliptic-oblong, obtuse, truncate or slightly cordate at the base, abruptly acuminate-apiculate at the apex, 9.5-22.5 cm. long and 5.5-12.5 cm. wide, subcoriaceous, the margins entire to somewhat undulate, the upper surface glabrous or nearly so and with impressed venation, the lower surface sparsely pubescent and with prominent venation, 5-nerved at the base. *Inflorescences* axillary, paniculate, the axes villous. *Flowers* hermaphrodite (or pistillate only?) or staminate, the pedicel 4-10 mm. long; calyx deeply (4-)5-lobate, 9-12 mm. long, the lobes linear-lanceolate, acute, 6.5-10 mm. long and 2-3 mm. wide, the outer surface puberulous-villous, the inner surface provided from the base to the middle of the lobes with a tiny appendage, the appendage villous especially near the base and cucullate at the apex, puberulous-villous above the appendage; gonophore of the staminate flowers filiform, arcuate, inflexed, glabrous except the much-thickened papillate base, 5.5-6 mm. long, the staminal tube pendulous, urceolate, very short, glabrous, the anthers 10, ca. 0.5 mm. long, the rudimentar ovary rather obsolete; gonophore of the hermaphrodite flowers (according to Pittier, Contr. U. S. Nat. Herb. **13**: 450, *fig.* 78. 1911) suberect, glabrous except the much-thickened papillate base and ca. 5 mm. long, the staminal tube cupuliform, ca. 0.8 mm. long and 2 mm. wide, glabrous, the anthers 10, the ovary depressed-globose, 5-sulcate, tomentellous, 5-locular, the styles reflexed, ca. 1.8 mm. long and tomentellous, the stigma indistinctly 5-lobulate. *Follicles* subglobose, obliquely apiculate, ca. 7(10-15) cm. in diam., shortly to-

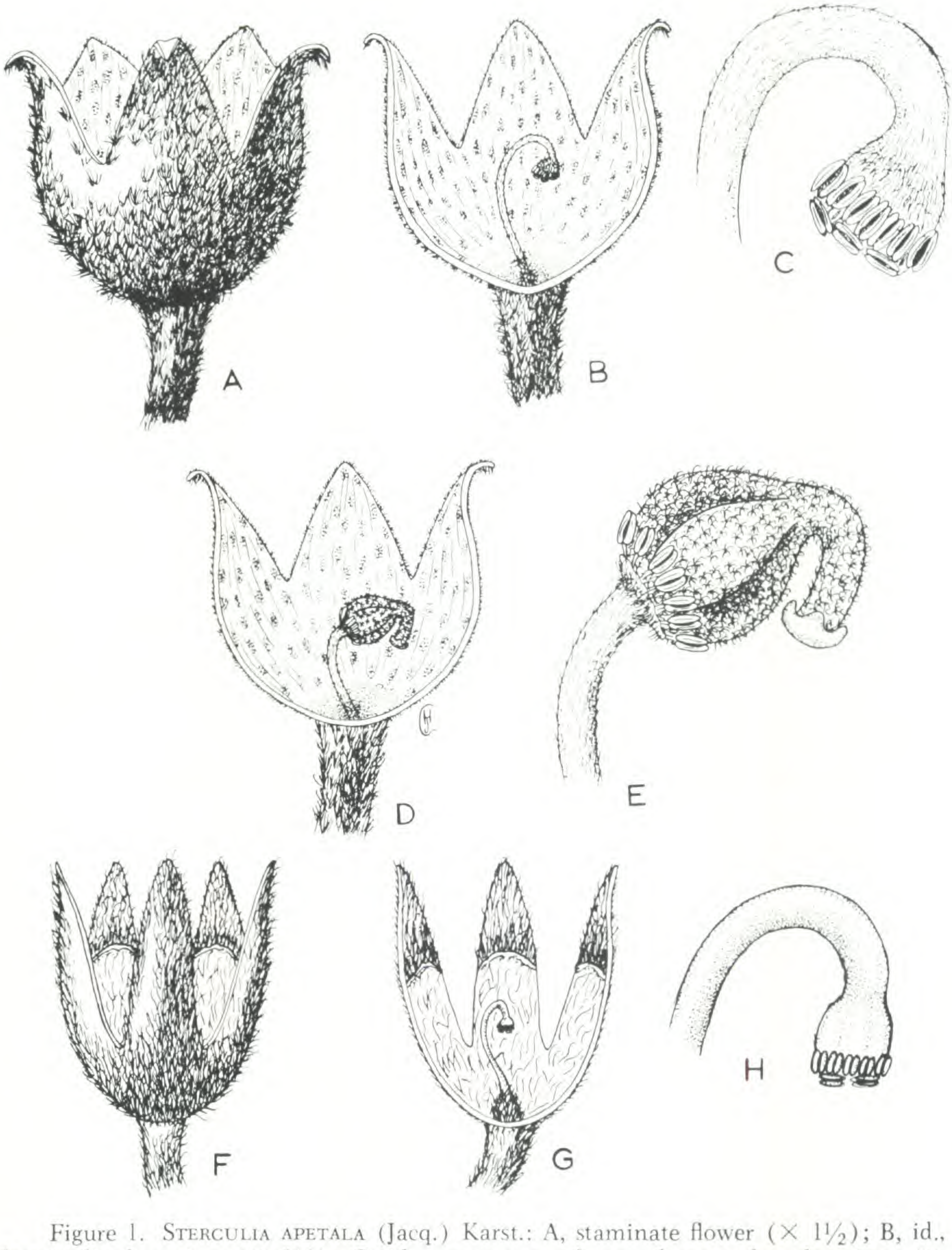

Figure 1. STERCULIA APETALA (Jacq.) Karst.: A, staminate flower (× 1½); B, id., longitudinal section (× 1½); C, id., upper part of gonophore and androecium (× 7½); D, hermaphrodite flower, longitudinal section (× 1½); E, id., upper part of gonophore, androecium and gynoecium (× 5). STERCULIA COSTARICANA Pittier: F. staminate flower (× 2½); G, id., longitudinal section (× 2½); H, id., upper part of gonophore and androecium (× 10).

mentellous; seeds ellipsoid-oblong, ca. 1.6 cm. long and 0.7 cm. thick, the testa covered with fine sharp hairs ca. 1.5-2 mm. long.

Costa Rica and Panama.

BOCAS DEL TORO: Changuinola Valley, *Cooper & Slater 104;* Cricamola Valley, Holstien pasture, *Cooper 536*.

2. WALTHERIA L.

WALTHERIA L., Sp. Pl. 673. 1753, Gen. Pl. ed. 5, 304. 1754.

Lophantus J. R. & G. Foster, Char. Gen. Pl. 27, *t.14*. 1776.
Astrophus Spreng., Neue Entdeck. **3**: 64. 1822.

Herbs or shrubs, the pubescence chiefly of stellate hairs. *Leaves* alternate, simple, petiolate, stipulate, the stipules deciduous, the blade crenate to serrate, 3- to 5-nerved at the base. *Inflorescences* axillary or terminal, of globose, sessile or pedunculate clusters, sometimes of scorpioid spikes or branched cymes. *Flowers* hermaphrodite, actinomorphous, sessile or subsessile, bracteolate; calyx gamosepalous, 5-lobate, 10-nerved, persistent; petals, 5, adnate to the base of the staminal tube, contorted, marcescent; stamens 5, more or less long-connate at the base into a staminal tube, the anthers 2-thecate, the thecae parallel, extrorse, more or less medifixus, longitudinally dehiscent; staminodes none; ovary sessile, 1-celled, 2-ovulate, the ovules ascending; style somewhat excentric, often geniculate near the middle; stigma clavate or plumose-papillate. *Capsules* 2-valved, 1(-2)-seeded, the seeds small, albuminous; embryo straight; cotyledons flat.

A pantropical genus of about 45 species, especially well represented in tropical America; only one species, *W. indica* L., is pantropical; two species are known from Panama.

a. Leaves soft-velvety-lanate-arachnoid on both sides, the nervation not reticulate; calyx ca. 4-4.5 mm. long, the lobes triangular-subulate; petals yellow or orange; staminal tube ca. 2 mm. long, the anthers subsessile .... 1. W. INDICA
aa. Leaves tomentellous when young to scabrous-puberulous later above, densely tomentellous beneath, the nervation reticulate; calyx ca. 5-6.5 mm. long, the lobes ovate-triangular and acuminate; petals white; staminal tube ca. 3-5 mm. long .... 2. W. GLOMERATA

1. WALTHERIA INDICA L., Sp. Pl. 673. 1753.—Fig. 2 (E).

Waltheria americana L., Sp. Pl. 673. 1753; Johnston, Sargentia **8**: 203. 1949.
Waltheria angustifolia L., Syst. Nat. ed.10, 1140. 1759.
Waltheria arborescens Cav., Mon. Cl. Diss. Dec. **6**: 316. 1788.
Waltheria elliptica Cav., loc. cit. 316, *t.171,2*. 1788.
Waltheria microphylla Cav., loc. cit. 317, *t.170,2*. 1788.
Waltheria ovata Cav., loc. cit. 317, *t.171,1*. 1788.
Waltheria corchorifolia Pers., Syn. Pl. **2**: 216. 1807.
Waltheria laevis Schrank, Pl. Rar. Hort. Acad. Monac. *t.55*. 1819.
Waltheria erioclada DC., Prodr. **1**: 493. 1827.
Waltheria guineensis Schumacher, Kongl. Danske Vidensk. Selskabs Naturv. Math. Afhandl. **4**: 69. 1829.
Waltheria africana Schumacher, loc. cit. 70. 1829.
Waltheria americana var. *elliptica* (Cav.) K. Schum. in Mart., Fl. Bras. **12**(3): 65. 1886.

Waltheria americana var. *densiflora* K. Schum. in Engl., Monogr. Afr. Pflanzenf. und -gatt. **5**: 46. 1900.
Waltheria americana var. *indica* (L.) K. Schum. in Engl., loc. cit. 47. 1900.
Waltheria americana var. *subspicata* K. Schum. in Engl., loc. cit. 47. 1900.
Waltheria Wildii Suesseng., Proc. Trans. Rhod. Sci. Ass. **43**: 107. 1951.

Herb or small shrub 0.60-2 m. high, the young stems grayish and soft-velvety-lanate-arachnoid. *Leaves* with a pedicel 0.5-3.3 cm. long, lanate-arachnoid to sericeous, the stipules subfiliform, the blade narrowly ovate to ovate, rounded or truncate or somewhat subcordate at the base, obtuse or subacute at the apex, 3.5-12 cm. long and 1.5-7 cm. wide, chartaceous, the margins serrate-crenate, grayish and soft-velvety-lanate-arachnoid on both sides, the indumentum slightly denser on the lower surface, the nervation not reticulate, impressed above and prominent below. *Inflorescences* axillary or terminal, of tight-globose, subsessile to long-pedunculate glomerules, the peduncles lanate-arachnoid to sericeous. *Flowers* sessile, the bracts linear-lanceolate, about as long as the flowers, sericeous; calyx tubular-campanulate, somewhat 5-angled, ca. 4-4.5 mm. long, divided about ½ way into 5 triangular-subulate lobes ca. 2-2.5 mm. long, long-sericeous outside, glabrous inside except the sericeous lobes; petals obovate-oblong, unguiculate, 4-4.5 mm. long and 1-1.5 mm. wide, yellow or orange, glabrous outside, scatteringly arachnoid near the base just above the claw inside; staminal tube ca. 2 mm. long, glabrous; anthers subsessile, ca. 0.8 mm. long; ovary oblong-ellipsoid, ca. 1.5 mm. long and 0.75 mm. wide, sericeous on the upper half; style geniculate in the middle, ca. 1.5 mm. long, loosely arachnoid; stigma plumose-papillate. *Capsule* included in the calyx and surrounded by the marcescent corolla, obovoid, ca. 2.5-3 mm. long and 1.5-2 mm. wide, sericeous above, 1-seeded; seed obovoid, ca. 1.8-2.1 mm. long and 1-1.3 mm. wide, the testa smooth.

A polymorphous, pantropical weed, extending to some subtropical regions, common especially in second-growth vegetation, along roads, in dry thickets and open forests.

CANAL ZONE: Corozal to Pedro Miguel, *Cowell 408;* Ancon Hill, *Bro. Heriberto 299, Killip 12057, Piper 5536.* COCLÉ: Aguadulce, *Pittier 4831;* vicinity of Natá, alt. 50 m., *Allen 844;* Penonomé, *Ebinger 1035, R. S. Williams 155;* between Las Margaritas and El Valle, *Woodson, Allen & Seibert 1264;* hills south of El Valle de Antón, alt. 600-800 m., *Allen 2856;* vicinity of Santa Clara Beach, *Woodson, Allen & Seibert 1702;* Santa Clara, *Ebinger 1132.* HERRERA: vicinity of Chitré, alt. ca. 20 m., *Allen 1105.* PANAMA: sabanas north of Panama City, *Bro. Paul 564;* vicinity of Bella Vista, *Piper 5341;* vicinity of Juan Franco Race Track, near Panama, *Standley 27708;* Riomar, Playa near the Río Mar, *Ebinger 500;* Taboga Island, *Allen 1292, Bro. Celestine 48, Macbride 2813;* San José Island, *Erlanson 40, 477, Harlow 83, Johnston 88.* VERAGUAS: Isla de Coiba (Colonia Penal), *Dwyer 1547.* PROVINCE UNKNOWN: *Seemann 95.*

2. WALTHERIA GLOMERATA Presl, Rel. Haenk. **2**: 152. 1835.—Fig. 2(A-D).

Waltheria brevipes Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 213. 1858.
Waltheria rhombifolia J. D. Sm., Bot. Mag. **23**: 3. 1897.

Shrub 1.5-2 m. high, the young branches tomentellous to puberulous. *Leaves* shortly petiolate, the petiole 0.5-1 cm. long, puberulous to tomentellous, the stipules narrowly triangular-acuminate and ca. 0.8-0.9 cm. long; blade oblong-elliptic or

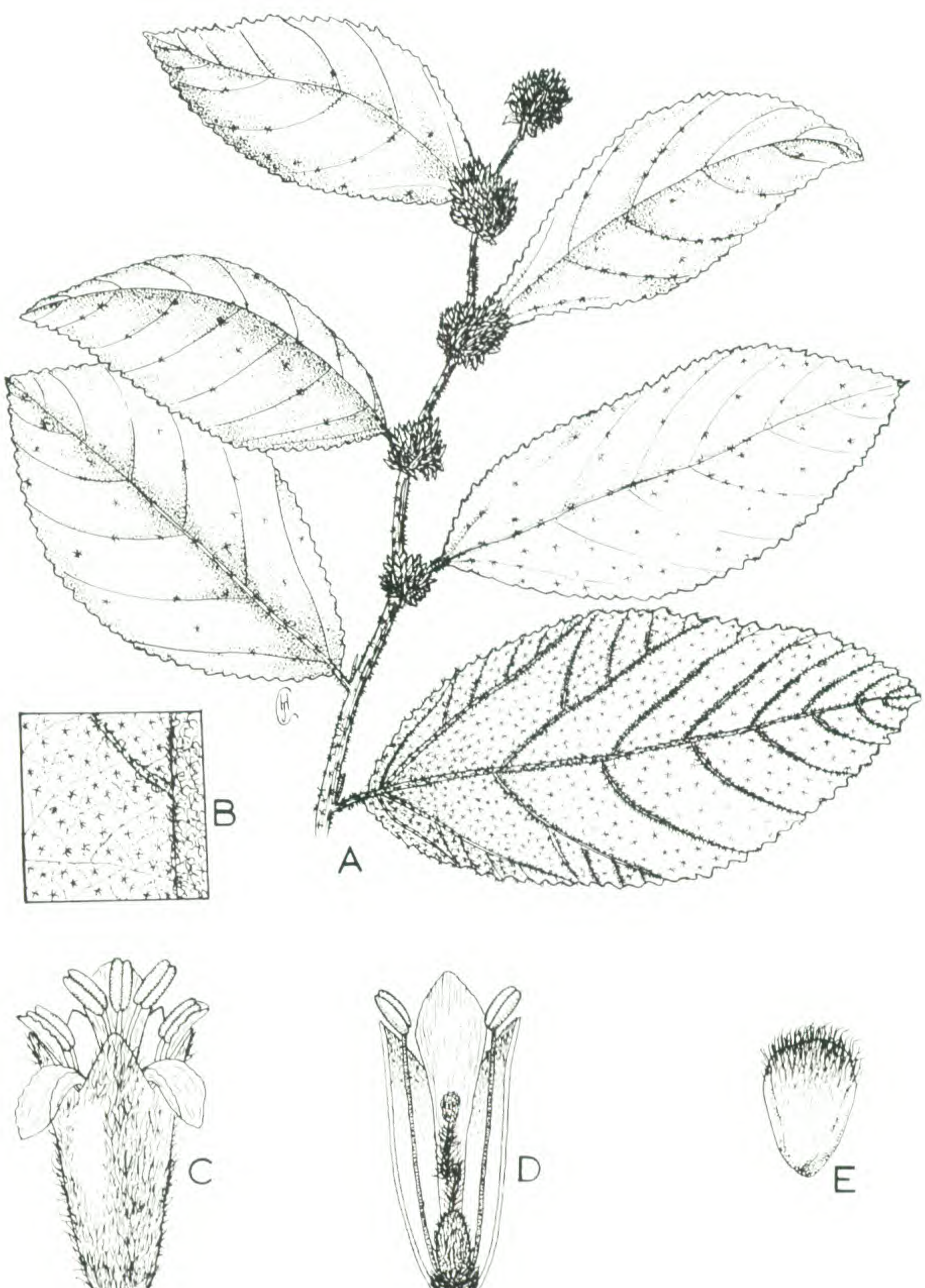

Figure 2. Waltheria glomerata Presl: A, flowering branch (× ⅔); B, detail of indumentum on the lower leaf-surface; C, flower (× 6⅔); D, id., longitudinal section (× 6⅔). Waltheria indica L.: E, capsule (× 6⅔).

elliptic or even slightly obovate, obtuse or truncate to subcordate at the base, acute at the apex, 6-13 cm. long and 2-8 cm. wide, chartaceous, discolor, the margins irregularly serrate, tomentellous when young to scabrous-puberulous later above, whitish-tomentellous beneath, the nervation reticulate, impressed above and prominent beneath. *Inflorescences* axillary, of densely globose, usually shortly pedunculate, solitary or fasciculate glomerules. *Flowers* sessile, subtended by several bracts, these distinct or 2- to 3-connate, linear to linear-obovate, acute at the apex, equalling more or less the calyx, tomentellous and with 2 tiers of hairs outside, a lower tier with appressed hairs and an upper one with long sericeous hairs, tomentellous-sericeous inside; calyx obovate-tubular, 5-angled and carinate, ca. 5-6.5 mm. long and ca. 2.5 mm. wide, the lobes ovate-triangular, acuminate and ca. 1.5-2.5 mm. long, tomentellous and with 2 tiers of hairs outside, a lower tier with short appressed hairs and an upper one with long sericeous hairs, shortly puberulous to tomentellous on the upper half inside; petals narrowly obovate-spatulate, unguiculate, rounded at the apex, ca. 5-7 mm. long and 1-2 mm. wide, white, glabrous; staminal tube very short, ca. 1-1.2 mm. long, glabrous, the filaments 3-5 mm. long; anthers ca. 1 mm. long; ovary narrowly obovoid, ca. 1 mm. long and 0.5 mm. broad, sericeous; style geniculate near the middle, ca. 2-2.5 mm. long, hirsute; stigma ca. 0.8-1 mm. long, densely plumose-papillate. *Capsule* unknown.

Mexico, Costa Rica and Panama, on hills, up to 800 m.

CANAL ZONE: around Las Cruces, alt. 20-100 m., *Pittier 2618;* Summit, *Standley 26955;* Cerro Gordo, near Culebra, *Standley 25958;* Ancon Hill, *Bro. Celestine 67, R. S. Williams 44;* Ancon Hill near Quarantine Station, *Pittier s.n.;* Balboa Heights, *J. M. & M. T. Greenman 5060;* hills east of Curundu, *Harvey 5207.* COCLÉ: Aguadulce, near sea level, *Pittier 4980;* hills south of El Valle de Antón, *Allen 2527, 2819.* HERRERA: vicinity of Ocú, 100 m., *Allen 4057.* PANAMA: road to San Carlos, *Harvey 5150;* hills above Campana, alt. 600-800 m., *Allen 1303;* hills between Capira and Potrero, 80-130 m. *Dodge & Hunter 8644;* vicinity of Panama, *Macbride 2619;* sabanas northeast of Panama City, *Bro. Paul 200;* vicinity of Bella Vista, *Piper 5385;* Punta Paitilla, *Bro. Heriberto 216, Piper 5402;* near Punta Paitilla, *Standley 26302;* near Matias Hernández, *Standley 28864;* between Matias Hernández and Juan Díaz, *Standley 31979;* Juan Díaz, *Standley 30636;* Río Tocumen, *Standley 29464;* near Pacora River, *Miller 1783;* along road between Panama and Chepo, *Dodge Hunter, Steyermark & Allen 16651.* VERAGUAS: hills west of Soná, alt. ca. 500 m., *Allen 1051.* PROVINCE UNKNOWN: *Haenkel s.n., Hayes 14, 153.*

3. MELOCHIA L.

MELOCHIA L., Sp. Pl. 774. 1753, Gen. Pl. ed. 5, 304, 1754.

Visenia Houtt., Nat. Hist. **2**(8): 308. 1778.
Altheria Du Petit-Thouars, Gen. Nov. Madag. 19. 1806 (1808?).
Riedlea Ventenat, Mém. Math. Phys. Inst. Nat. Fr. **1**: 2. 1807.
Mougeotia H. B. K., Nov. Gen. Sp. Pl. **5**: 326. 1823.
Aleurodendron Reinwardt, Syll. Pl. Nov. (Ratisb.) **2**: 12. 1828.
Polychlaena G. Don, Gen. Syst. Gard. Bot. **1**: 488. 1831.
Physodium Presl, Rel. Haenk. **2**: 150. 1835.
Lochemia Arnott, Ann. Sci. Nat., Bot., ser.2, **11**: 172, 1839.
Anamorpha Karst. & Triana, Linnaea **28**: 443. 1856.
Physocodon Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 212. 1858.

Herbs, undershrubs or shrubs, infrequently small trees, the pubescence of simple or stellate hairs, sometimes of gland-tipped hairs. *Leaves* alternate, simple, petiolate, stipulate, the stipules deciduous, the blade crenate or serrate, usually 5-nerved at the base. *Inflorescences* axillary or terminal, rarely oppositifolious, paniculiform or of cymose clusters, the clusters sessile or pedunculate, forming sometimes interrupted or continuous, leafy spikes. *Flowers* hermaphrodite, actinomorphous, often heterostyled, sessile or pedicellate, generally bracteolate, the bracts persistent; calyx gamosepalous, 5(6)-lobate or -lobulate, persistent or sometimes accrescent; petals 5, unguiculate at the base, more or less long-adnate to the base of the staminal tube, contorted, marcescent; stamens 5, more or less long-monadelphous, the anthers 2-thecate, the thecae parallel, extrorse, more or less medifixus, longitudinally dehiscent; staminodes none or infrequently obsolete; ovary sessile or sometimes shortly stipitate, 5-celled, the cells oppositipetalous, 2-ovulate; styles 5, free or connate at the base, the stigmas minutely tuberculate or plumose-papillate. *Capsules* sessile or shortly stipitate, globose and 5-lobate or pyramidal and sometimes 5-winged, 5-celled, each cell 1-seeded, rarely 2-seeded, the dehiscence either loculicidal or septicidal, the capsule separating into 5 cocci, each coccus opening by the inner angle or splitting completely into 2 valves; seeds small, ascending, 3-angular, dorsally convex, rarely winged, albuminous; embryo straight; cotyledons flat.

A pantropical genus of about 65 species, especially well represented in tropical America; five species, of which one is introduced (*M. corchorifolia*), are reported at the present time from Panama.

a. Cocci opening along the inner angle.
  b. Inflorescences of solitary or mostly fascicled, shortly pedunculate, umbelliform cymes; flowers shortly pedicellate, the pedicel 2.2-3 mm. long; calyx much-accrescent; petals white; ovary very shortly stipitate .... 1. M. LUPULINA
  bb. Inflorescences of dense, sessile or subsessile, more or less globose clusters; flowers sessile or subsessile; calyx persistent; petals pink; ovary sessile .... 2. M. NODIFLORA
aa. Cocci splitting completely into 2 valves.
  c. Inflorescences of axillary or terminal, sessile or shortly pedunculate cymes; flowers 2.5-5.5 mm. long; staminal tube glabrous; leaves long-petiolate, sparsely pubescent.
    d. Inflorescences and flowers sessile or subsessile; calyx outside and capsules hispidulous and with simple or stellate hairs; ovary sericeous; styles free.
      e. Young stems hispidulous all round; flowers 2.5-3.4 mm. long; calyx ca. 1.5-2 mm. long; capsule ca. 1.8-2.5 mm. long and 2.5-3 mm. in diam.; seed ca. 1.4-1.8 mm. long .... 3. M. MELISSIFOLIA
      ee. Young stems puberulous and with a row of hairs decurrent from the stipule-bases; flowers 4.5-5.5 mm. long; calyx ca. 3 mm. long; capsule ca. 3.5-4 mm. long and 4-5 mm. in diam.; seed 3-3.4 mm. long .... 4. M. CORCHORIFOLIA
    dd. Inflorescences shortly pedunculate; flowers shortly pedicellate, the pedicel 1.5-4 mm. long; calyx outside and capsules hispidulous and chiefly with gland-tipped hairs; ovary nearly glabrous; styles connate at the base .... 5. M. MANDUCATA
  cc. Inflorescences of axillary and terminal, dense, sessile or subsessile clusters forming interrupted or continuous, leafy spikes; flowers 7-8.5 mm. long; staminal tube generally sparsely hirtellous; leaves shortly petiolate, densely pubescent .... 6. M. VILLOSA

1. MELOCHIA LUPULINA Sw., Nov. Gen. Sp. Pl. Prodr. 97. 1788; Standley, Contr. Arnold Arb. **5**: 104. 1933.

Mougeotia inflata H. B. K., Nov. Gen. Sp. Pl. **5**: 330, *t.484.* 1823.
Riedlea inflata (H. B. K.) DC., Prodr. **1**: 491. 1824.
Visenia inflata (H. B. K.) Spreng. in L., Syst. Veg. ed. 16, **3**: 30. 1826.
Visenia lupulina (Sw.) Spreng. in L., loc. cit. 31. 1826.
Melochia inflata (H. B. K.) Benth., Bot. Voy. Sulph. 71. 1844.
Riedlea lupulina (Sw.) Beurling, Kongl. Sv. Vet.-akad. Handl. 1854: 115. 1854 (?).
Anamorpha waltherioides Karst. & Triana, Linnaea **28**: 443. 1856.

Herb, undershrub or shrub, erect or sometimes procumbent, 0.60-2 m. high, the young stems and branches villous, the hairs simple or stellate. *Leaves* rather long-petiolate, the petiole slender, slightly canaliculate above, up to 5 cm. long, more or less densely villous, the stipules filiform, up to 4 mm. long; blade ovate, cordate at the base, acuminate at the apex, up to 10 cm. long and 7 cm. wide, chartaceous, the margins serrate-crenate, loosely to densely softly velutinous, the indumentum always denser on the lower surface, usually 5(-7)-nerved at the base, the nervation slightly prominent beneath. *Inflorescences* axillary, of solitary or mostly fascicled, umbelliform cymes, the cymes shortly pedunculate, the peduncles densely stellate-puberulous. *Flowers* 4-4.7 mm. long, heterostyled, shortly pedicellate, the pedicel 2.2-3 mm. long and densely stellate-puberulous, the bracts linear-subulate, 1.5-2.5 mm. long, stellate-puberulous and ciliolate; calyx globose-campanulate, ca. 4-4.5 mm. long and 4 mm. wide, the lobes triangular, acute or acuminate, ca. 1.8-3 mm. long and 1.5-2 mm. wide at the base, stellate-puberulous outside, glabrous inside, much-accrescent; petals obovate, shortly unguiculate and slightly adnate to the base of the staminal tube, rounded at the apex, ca. 4-4.7 mm. long and 1.7-2 mm. wide, white; long-styled flowers with a staminal tube ca. 2-2.5 mm. long and glabrous, the anthers sessile or nearly so and ca. 0.8-1 mm. long, the ovary shortly stipitate, ellipsoid to oblong, ca. 1-1.5 mm. long and 0.8-0.9 mm. in diam., shortly and densely sericeous, the styles free, ca. 2.5-2.8 mm. long, stellate-hirtellous near the base, the stigmas papillate; short-styled flowers with a staminal tube ca. 1.6-1-7 mm. long and glabrous, the filaments ca. 2-2.2 mm. long, the anthers ca. 0.8-0.9 mm. long, the ovary very shortly stipitate, ellipsoid, ca. 1-1.2 mm. long and 0.7-0.8 mm. in diam., shortly and densely sericeous, the styles free, ca. 1.7-1.9 mm. long, the stigmas papillate. *Capsule* surrounded by the accrescent calyx, depressed-globose, ca. 2.2-2.3 mm. long and 2.7-3 mm. in diam., shortly stellate-puberulous, each coccus ca. 1.3 mm. thick, opening along the inner angle; seed ca. 1.4-1.7 mm. long and 1.1 mm. thick.

A common, often weedy species dispersed throughout the American tropics and growing in moist thickets, on brushy slopes and in weedy fields.

BOCAS DEL TORO: Almirante, *Skutch 1;* region of Almirante, Farm Six, *Cooper 190;* vicinity of Monkey Hill, *Cowell 39;* Changuinola Valley, along railroad, *Dunlap 334;* vicinity of Chiriquí Lagoon, Water Valley, *von Wedel 1671, 1848;* locality unknown, *Carleton 183.* CANAL ZONE: Mindi, *Cowell 184;* Gatun, *Bro. Heriberto 22;* hills west of the Canal, near Gatun, *Standley 27273;* forest along telephone trail between the Río Indio Hydrographic Station and the Natural Bridge of Río Puente, Casa Larga trail, *Dodge &*

Allen 17484; Barro Colorado Island, *Shattuck 656, Wetmore & Abbe 33, 86, Wilson 19, Woodworth & Vestal 629;* Frijoles, *Standley 27640;* Darien Station, *Standley 31524;* Gamboa, *Standley 28329, 28501;* Obispo, *Standley 31772;* Empire to Mandinga, *Piper 5460;* Las Cascadas Plantation, near Summit, *Standley 25817, 29630;* Summit, *Standley 26932;* Summit, exp. gardens, *Woodworth & Vestal A50A;* vicinity of Summit, *Standley 30059;* Río Grande, near Culebra, 50-100 m., *Pittier 2109;* Paraiso Sta., *Hayes 30;* Pedro Miguel, *Piper 5498.* COCLÉ: vicinity of El Valle, 800-1,000 m., *Allen 80.* COLÓN: Juan Mina Plantation, Río Chagres, 25 m., *Allen 4118.* DARIEN: Marraganti and vicinity, *R. S. Williams 1002;* along Sambú River, *Pittier 5537;* vicinity of Pinogana, *Allen 4280.* PANAMA: hills between Capira and Potrero, 80-130 m., *Dodge & Hunter 8636, 8637;* Agricultural Experiment Station at Matias Hernández, *Pittier 6900;* vicinity of Matias Hernández, *Standley 32063;* Río Tapia, *Standley 28053.* PROVINCE UNKNOWN: *Hayes 786, Sinclair s.n.*

2. MELOCHIA NODIFLORA Sw., Nov. Gen. Sp. Pl. Prodr. 97. 1788.

Mougeotia nodiflora (Sw.) H. B. K., Nov. Gen. Sp. Pl. **5**: 330. 1823.
Riedlea nodiflora (Sw.) DC., Prodr. **1**: 491. 1824.
Visenia nodiflora (Sw.) Spreng. in L., Syst. Veg. ed. 16, **3**: 30. 1826.

Shrub, sometimes herb or undershrub, 1-3.5 m. high, the young stems and branches slightly pilose, the hairs chiefly stellate. *Leaves* short- to long-petiolate, the petiole slender, 0.5-3 cm. long, more or less densely stellate-hispidulous, the stipules linear-lanceolate, 4-5 mm. long; blade ovate, rounded or slightly subcordate at the base, acuminate at the apex, up to 12 cm. long and 6.5 cm. wide, membranous, the margins serrate, more or less densely appressed-pilose, the indumentum denser on the lower surface, becoming glabrescent, the nervation slightly prominent beneath. *Inflorescences* axillary, of dense, sessile or subsessile, more or less globose clusters. *Flowers* 4.5-5.3 mm. long, sessile or subsessile, the bracts distinct or 2- to 3-connate, linear to linear-subulate, stellate-puberulous and ciliolate; calyx campanulate, ca. 3.5-4 mm. long and 3 mm. wide, the lobes triangular, somewhat caudate-acuminate, ca. 2.2-3 mm. long and 1-1.5 mm. wide at the base, stellate-puberulous and appressed-pilose outside, glabrous inside, persistent; petals oblong-obovate, shortly unguiculate and more or less long-adnate to the base of the staminal tube, rounded at the apex, ca. 4.5-5.3 mm. long and 1.7-1.9 mm. wide, pink; staminal tube ca. 2.5 mm. long, glabrous, the anthers subsessile and ca. 0.8 mm. long; ovary sessile, oblong to oblong-ellipsoid, ca. 1-1.4 mm. long and 0.7-1.2 mm. in diam., sericeous and with simple hairs, the styles free and ca. 1.6-1.7 mm. long, the stigmas minutely papillate. *Capsule* surrounded by the persistent calyx, subglobose, ca. 3.5 mm. long and 3.8-4 mm. in diam., shortly stellate-puberulous and pilose, each coccus ca. 1.7 mm. thick, opening along the inner angle; seed ca. 2-2.2 mm. long and 1.2-1.3 mm. thick.

From southern Mexico to Panama, West Indies and western South America from Colombia to Peru; chiefly in open, wet habitats and moist thickets.

CANAL ZONE: Las Cascadas Plantation, near Summit, *Standley 29649;* vicinity of Miraflores Lake, *P. White 260;* along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29149;* in Government forest along Las Cruces Trail, 75 m., *Hunter & Allen 733, 748;* Balboa, *Standley 25545, 27126, 29260, 32112.* PANAMA: vicinity of San Carlos, alt. 0-10 m., *Allen 1140;* Panama City, *Macbride 2618;* Bella Vista, *Standley 25301;* between Las Sabanas and Matias Hernández, *Standley 31847;* Agricultural Experiment Station at Matias Hernández, *Pittier 6905;* near Matias Hernández, *Standley 28870;* between Matias Hernández and Juan Díaz, *Standley 32092;* near Chepo, 30 m., *Hunter & Allen 61;* Pearl Islands, *Johansen 116.* PROVINCE UNKNOWN: *Cowell 286, Hayes 154, 786A.*

3. MELOCHIA MELISSIFOLIA Benth., Hook. Jour. Bot. **4**: 129. 1842; Johnston, Sargentia **8**: 203. 1949.—Fig. 3.

Melochia bracteosa F. Hoffmann, Beitr. Kenntn. Fl. Centr.-Ost-Afr. 13. 1889.
Melochia crinata R. Br. ex Hiern, Cat. Afr. Pl. Welw. **1**: 90. 1896.
Melochia Welwitschii Hiern, loc. cit. 91. 1896.
Melochia melissifolia var. *microphylla* K. Schum. in Engl., Monogr. Afr. Pflanzenfam. und -gatt. **5**: 43. 1900.
Melochia melissifolia var. *brachyphylla* K. Schum. in Engl., loc. cit. 43. 1900.
Melochia melissifolia var. *bracteosa* (F. Hoffmann) K. Schum. in Engl., loc. cit. 43. 1900.
Melochia melissifolia var. *Welwitschii* (Hiern) K. Schum. in Engl., loc. cit. 43. 1900.
Melochia melissifolia var. *mollis* K. Schum. in Engl., loc. cit. 43. 1900.
Melochia mollis (K. Schum.) Hutch. & Dalz., Fl. W. Trop. Afr. **1**: 250. 1928.

Herb, sometimes undershrub, 0.30-1 m. high, the young stems hispidulous, the hairs chiefly stellate. *Leaves* rather small, long-petiolate, the petiole slender, 0.7-3 cm. long, hispidulous, the stipules linear, acute, 4-7 mm. long, long-ciliolate; blade lanceolate or ovate to broadly ovate, rounded or truncate or subcordate at the base, subacute to acute at the apex, up to 4.5 cm. long and 2.5 cm. wide, membranous, the margins serrate-crenate, sparsely appressed-hispidulous and with chiefly simple hairs, the nervation slightly prominent beneath. *Inflorescences* axillary, of subsessile glomerules. *Flowers* 2.5-3.4 mm. long, subsessile or sessile, the bracts linear-subulate, ca. 3.5-5 mm. long, hispidulous and long-ciliolate; calyx campanulate, ca. 1.5-2 mm. long and 2 mm. broad, the lobes from a large base acuminate, ca. 0.5-0.8 mm. long and 1 mm. wide at the base, sparsely appressed-hispidulous and with simple hairs outside, glabrous inside, persistent; petals obovate or oblong-obovate, shortly unguiculate and slightly adnate to the base of the staminal tube, rounded at the apex, ca. 2.5-3.4 mm. long and 0.8-1.8 mm. wide, pink; staminal tube ca. 1-1.2 mm. long, glabrous, the filaments ca. 0.5 mm. long, the anthers ca. 0.5 mm. long; ovary sessile, subglobose, ca. 0.8 mm. long and 0.6-0.7 mm. in diam., sericeous, the styles free and ca. 1-1.4 mm. long, the stigmas very minutely tuberculate. *Capsule* surrounded by the persistent calyx, subglobose to depressed-globose, ca. 1.8-2.5 mm. long and 1.8-3 mm. in diam., hispidulous, each coccus ca. 1.5 mm. thick, splitting completely into 2 valves; seed ca. 1.4-1.8 mm. long and 0.8-1.3 mm. thick, the testa dorsally rugulose.

A polymorphic, weedy species distributed in tropical America and in tropical Africa; in tropical America it ranges from Costa Rica to northern South America and usually grows in wet habitats.

CANAL ZONE: hills west of the Canal, near Gatun, *Standley 27271;* Gamboa, *Standley 28364;* Summit, *Standley 26925;* Las Cascadas Plantation, near Summit, *Standley 29629;* vicinity of Summit, *Standley 30131;* Cerro Gordo near Culebra, *Standley 26028;* Corozal, *Standley 27351;* Balboa, *Standley 25520.* COCLÉ: Aguadulce, *Pittier 4833.* COLÓN: between France Field, Canal Zone and Catival, *Standley 30384.* PANAMA: along the Corozal road, near Panama, *Standley 26863;* Paitilla, *Bro. Heriberto 235;* Nuevo San Francisco, *Standley 30756;* vicinity of Juan Franco Race Track, near Panama, *Standley 27756;* north of Panama City, *Bro. Paul 586;* near Matias Hernández, *Standley 28992;* Río Tocumen, *Standley 29435;* near the big swamp east of the Río Tocumen, *Standley 26496;* Laguna de Portala, near Chepo, 50 m., *Pittier 4619;* San José Island, *Johnston 898.*

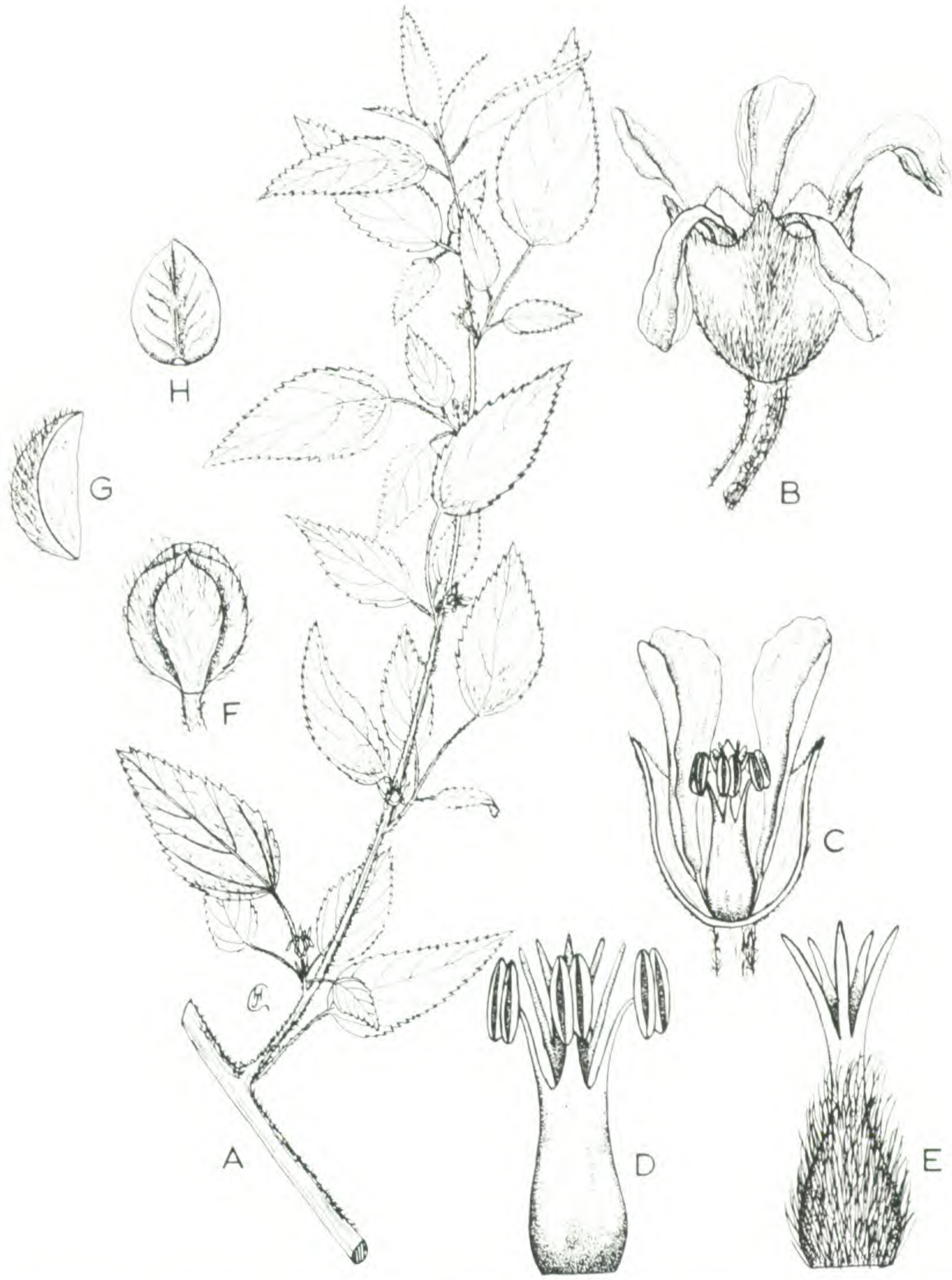

Figure 3. MELOCHIA MELISSIFOLIA Benth.: A, flowering branch (× ½); B, flower (× 10); C, id., longitudinal section (× 10); D, androecium (× 20); E, gynoecium (× 20); F, capsule (× 7½); G, coccus (× 7½); H, seed (× 10).

4. MELOCHIA CORCHORIFOLIA L., Sp. Pl. 675. 1753; Johnston, Sargentia **8:** 203. 1949.

Melochia supina L., Sp. Pl. 675. 1753.
Melochia truncata Willd. in L., Sp. Pl. ed.4[i.e. 5], **3:** 601. 1880.
Riedlea corchorifolia (L.) DC., Prodr. **1:** 491. 1824.
Riedlea supina (L.) DC., loc. cit. 491. 1824.
Riedlea truncata (Willd.) DC., loc. cit. 491. 1824.
Visenia corchorifolia (L.) Spreng. in L., Syst. Veg. ed.16, **3:** 30. 1826.
Visenia supina (L.) Spreng. in L., loc. cit. 31. 1826.

Herb or undershrub, 0.30-2 m. high, the young stems stellate-puberulous and with a row of stellate hairs decurrent from the stipule-bases. *Leaves* long-petiolate, the petiole slender, up to 2.8 cm. long, stellate-puberulous, the stipules linear-filiform, 4-6 mm. long and ciliate; blade ovate to broadly ovate, rounded or truncate or subcordate at the base, subacute to acute at the apex, up to 4.5 cm. long and 3.5 cm. wide, membranous, the margins serrate, sparsely appressed-hispidulous especially along the nerves and with chiefly simple hairs, the indumentum somewhat denser on the lower surface than on the upper one, the nervation slightly prominent beneath. *Inflorescences* terminal or axillary, of dense, sessile, clustered cymes. *Flowers* ca. 4.5-5.5 mm. long, sessile, subtended by 4 bracts, the bracts linear-filiform, 4-5.5 mm. long, hispidulous and ciliate; calyx broadly campanulate, ca. 3 mm. long and wide, the lobes usually 5, sometimes 6, from a broad base abruptly short-acuminate, ca. 0.5 mm. long and 1.2 mm. wide at the base, appressed-hispidulous outside, glabrous inside, persistent; petals obovate, shortly unguiculate and slightly adnate to the base of the staminal tube, rounded at the apex, ca. 4.5-5.5 mm. long and 1.7-2.5 mm. wide, pale pink; staminal tube ca. 1.5 mm. long, glabrous, the filaments ca. 1 mm. long, the anthers ca. 0.8-1 mm. long; ovary subglobose, ca. 1 mm. in diam., densely sericeous, the styles free and ca. 1.5-2 mm. long, the stigmas minutely tuberculate. *Capsule* surrounded by the persistent calyx, more or less globose, ca. 3.5-4 mm. long and 4-5 mm. in diam., hispidulous and with mostly simple hairs, each coccus ca. 2.5 mm. thick, splitting completely into 2 valves; seed ca. 3-3.4 mm. long and 1.5-2.3 mm. thick, the testa minutely rugulose.

An Old World species introduced in America, where it is well established in southeastern United States; in Panama it is only reported from San José Island, where it was first collected in 1945 by Erlanson.

PANAMA: San José Island, at Goat Farm, near Río Mato Puerco, *Erlanson 189, Johnston 1243.*

5. MELOCHIA MANDUCATA Wright & Sauvalle in Sauvalle, Fl. Cubana 14. 1873.

Herb or undershrub, 0.30-1 m. high, the young stems usually with a row of short stellate hairs decurrent from the stipule-bases, sometimes also with few gland-tipped hairs. *Leaves* long-petiolate, the petiole slender, canaliculate and stellate-puberulous above, rounded and nearly glabrous beneath, 0.7-3 cm. long, the stipules linear-lanceolate, ca. 4-5 mm. long and ciliolate; blade ovate to broadly ovate, rounded at the base, acute at the apex, up to 5.5 cm. long and 3.5 cm. wide, membranous, the margins irregularly serrate or doubly serrate, sparsely

and shortly appressed-pilose especially along the nerves, the nervation very slightly prominent beneath. *Inflorescences* axillary or terminal, of solitary or mostly fasciculate, more or less clustered cymes, the cymes shortly pedunculate, the peduncles generally glabrous. *Flowers* ca. 2.7 mm. long, shortly pedicellate, the pedicel 1.5-4 mm. long, generally glabrous, the bracts 3, linear-lanceolate, ca. 3 mm. long, ciliolate; calyx broadly campanulate, ca. 2 mm. long and 1.8-2 mm. wide, the lobes abruptly and shortly acuminate, ca. 0.5 mm. long and 1 mm. wide at the base, sparsely hispidulous and chiefly with gland-tipped hairs outside, glabrous inside, persistent; petals oblong-obovate, shortly unguiculate and slightly adnate to the base of the staminal tube, rounded at the apex, ca. 2.7 mm. long and 1 mm. wide, pink; staminal tube ca. 1.5 mm. long, glabrous, the anthers shortly stipitate, ca. 0.5 mm. long; ovary sessile, ellipsoid, ca. 0.7 mm. long and 0.5 mm. in diam., nearly glabrous, the styles connate at the base, ca. 1-1.1 mm. long, the stigmas obscurely tuberculate. *Capsule* surrounded by the persistent calyx, depressed-globose, ca. 3-3.5 mm. long and 4.5 mm. in diam., hispidulous and chiefly with gland-tipped hairs, each coccus ca. 2 mm. thick, splitting completely into 2 valves; seed ca. 2.2-2.5 mm. long and 1.2 mm. thick.

Cuba, Panama and probably Colombia; from Panama I have seen only one collection; in swampy ground.

PANAMA: near the big swamp east of the Río Tocumen, *Standley 26655*.

The description of the above species agrees pretty well with the description of the Mexican species: *M. glandulifera* Standley (Contr. U. S. Nat. Herb. **23**: 803. 1923), but comparison with the type-specimen is necessary before this species can be reduced to synonymy.

6. MELOCHIA VILLOSA (Mill.) Fawc. & Rendl., Fl. Jamaica **5**: 165. 1926.

Sida villosa Mill., Gard. Dict. ed.8. 1768.
Melochia hirsuta Cav., Mon. Cl. Diss. Dec. **6**: 323, *t.175(1)*. 1788.
Riedlea serrata Ventenat, Choix de Plantes *t.*37. 1808.
Mougeotia hirsuta (Cav.) H. B. K., Nov. Gen. Sp. Pl. **5**: 331. 1823.
Riedlea hirsuta (Cav.) DC., Prodr. **1**: 492. 1824.
Visenia serrata (Ventenat) Spreng. in L., Syst. Veg. ed.16, **3**: 30. 1826.
Visenia hirsuta (Cav.) Spreng. in L., loc. cit. 30. 1826.
Melochia clinopodium St.-Hil. & Naud., Ann. Sci. Nat., Bot., ser.2, **18**: 36. 1842.
Melochia serrata (Ventenat) St.-Hil. & Naud., loc. cit. 36. 1842.
Melochia vestita Benth., Hook. Jour. Bot. **4**: 130. 1842.
Riedlea heterotricha Turcz., Bull. Soc. Imp. Nat. Moscou **31**(1): 211. 1858.

Herb or undershrub, erect or sometimes decumbent, 0.30-1 m. high, the young stems more or less densely stellate-puberulous and long-pilose-arachnoid, sometimes with gland-tipped hairs near the apex. *Leaves* shortly petiolate, the petiole canaliculate above, 0.5-1(-2) cm. long, more or less densely sericeous, the stipules linear-lanceolate, 5-6 mm. long, long-ciliate; blade oblong-ovate to ovate, rounded to mostly cordate at the base, acute at the apex, up to 5.5 cm. long and 3 cm. wide, chartaceous, the margins doubly serrate, more or less densely and softly stellate-puberulous and long-sericeous, the indumentum always denser on the lower sur-

face, the nervation somewhat impressed above and prominent beneath. *Inflorescences* terminal or/and axillary, of dense, sessile or subsessile clusters forming interrupted or continuous, leafy spikes. *Flowers* 7-8.5 mm. long, heterostyled, sessile, subtended by 3-4 bracts, the bracts linear-filiform, ca. 6-8 mm. long, sericeous and long-ciliate, the hairs mostly simple, sometimes gland-tipped; calyx campanulate to broadly campanulate, ca. 4.5-5 mm. long and 4.5 mm. wide, the lobes from a broad base abruptly acuminate, ca. 1-2 mm. long and 1.7-2 mm. wide at the base, sericeous and mostly with simple hairs or stellate-puberulous and sericeous and often with gland-tipped hairs outside, glabrous inside, persistent; petals obovate, long-unguiculate and rather long-adnate to the base of the staminal tube for ca. 2-3 mm., rounded at the apex, ca. 7-8.5 mm. long and 2.2-3 mm. wide, pink to pinkish-purple; long-styled flowers with a staminal tube ca. 3.5-4.5 mm. long, generally sparsely hirtellous, the anthers sessile and ca. 1.5 mm. long, the ovary sessile, oblong-ellipsoid, ca. 1.5 mm. long and 0.75-0.9 mm. in diam., densely sericeous, the styles shortly connate at the base, ca. 5.5-6.5 mm. long, the stigmas plumose-papillate; short-styled flowers with a staminal tube ca. 2.6-2.7 mm. long, generally sparsely hirtellous, the filaments ca. 2.5-3 mm. long, the anthers ca. 1.5 mm. long, the ovary sessile, oblong, ca. 1.5 mm. long and 0.6-0.7 mm. in diam., densely sericeous, the styles shortly connate at the base, ca. 3-3.5 mm. long, the stigmas obscurely tuberculate. *Capsule* surrounded by the persistent calyx, depressed-globose, ca. 2.5 mm. long and 3 mm. in diam., stellate-puberulous and sericeous especially on the upper part, each coccus ca. 1.5-1.8 mm. thick, splitting completely into 2 valves; seed ca. 1.8-2 mm. long and 1.3 mm. thick, the testa minutely tuberculate.

Throughout tropical America and introduced in Africa (Madagascar); usually in moist thickets or wet savannas.

CANAL ZONE: Chiva-Chiva trail, Red Tank to Pueblo Nuevo, *Piper 5757;* along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29087.* CHIRIQUÍ: Boquete, *Ebinger 745;* rocky plains about 5 miles south of Boquete, 3,000 ft., *Allen 4692;* vicinity of Boquete, *Stern, Chambers, Dwyer, Ebinger 1175;* Sabana de la Tortuga, between El Boquete and Caldera, 300-700 m., *Pittier 3304;* San Carlos, *Roy 4.* COCLÉ: Aguadulce, near sea level, *Pittier 4858;* between Porto Posada & Penonomé, *R. S. Williams 164;* El Valle de Antón, 500-700 m., *Seibert 475;* Llano Bonito, north of Las Margaritas, 400-500 m., *Seibert 543.* PANAMA: near Arraijan, ca. 15 m., *Woodson, Allen, Seibert 1388;* Nuevo San Francisco, *Standley 30748;* La Sabana de Panama, *Bro. Gervais 159;* Sabanas Road, *Killip 3122;* Sabanas, *Bro. Paul 74, Standley 25845, 25934;* Agricultural Experiment Station at Matias Hernández, *Pittier 6797, 6875;* near Matias Hernández, *Standley 28897;* between Matias Hernández and Juan Díaz, *Standley 31980;* Río Tapía, *Standley 28300;* near Tapía River, Juan Díaz region, *Maxon & Harvey 6632;* Tocumen, *Dwyer 4069;* near the big swamp east of the Río Tocumen, *Standley 26506;* vicinity of Pacora, alt. ca. 35 m., *Allen 1002;* along road between Panama and Chepo, *Dodge, Hunter, Steyermark & Allen 16660;* Sabana de Juan Corso, near Chepo, alt. 60-80 m., *Pittier 4510.*

In *R. S. Williams 1152* (Coclé, Penonomé and vicinity), the indumentum differs from that of the above species. All the plant, vegetative and floral parts, is covered with a heterotrichous pubescence of stellate and gland-tipped hairs. Since most of the other floral characters agree with those of *M. villosa* and because the indumentum is a very variable character in the *Malvales*, I consider this collection, at the present time, as only an ecological variation.

4. HELICTERES L.

HELICTERES L., Sp. Pl. 963. 1753, Gen. Pl. ed. 5, 411. 1754

Isora Adans., Fam. Pl. **2**: 382. 1763.
Alicteres Neck., Elem. Bot. **2**: 304. 1790.
Methorium Schott & Endl., Melet. Bot. 29. 1832.
Orthothecium Schott & Endl., loc. cit. 31. 1832.
Anisora Rafin., Sylva Tellur. 74. 1838.
Nisoralis Rafin., loc. cit. 74. 1838.
Camaion Rafin., loc. cit. 75. 1838
Ozoxeta Rafin., loc. cit. 75. 1838.
Oudermansia Miq. in Junghuhn, Plant. Junghuhnianae 295. 1854.

Undershrubs, shrubs or small trees, the pubescence of stellate hairs. *Leaves* alternate, simple, petiolate, stipulate, the stipules caducous, the blade serrate, 3- to 7-nerved at the base. *Inflorescences* axillary or oppositifolious, fasciculate or flowers solitary. *Flowers* hermaphrodite, actinomorphous or zygomorphous, pedicellate, bracteolate; calyx gamosepalous, tubiform, either erect, regular and (4-)5-lobate, or horizontal, bilabiate and (2-4-)5-divided, the inner base glandular, deciduous; petals 5, contorted, long-unguiculate, the claws often appendiculate above the base, equal or not; gonophore well developed, longer than the calyx; stamens 6, 8, 10 or numerous, the filaments by pairs, the anthers 2-thecate, the thecae divergent or sometimes confluent, extrorse, longitudinally dehiscent; staminodes alternating with the pairs of stamens; ovary sessile, straight or spirally twisted, 5-celled, the cells many-ovulate; styles 5, free or coherent, filiform; stigmas acute or slightly capitate. *Fruit* borne on the accrescent gonophore, capsular, ligneous, straight or spirally twisted, the carpels separating at maturity by the rupture of the walls in the vicinity of the placenta (follicles); seeds numerous, small and angular; albumen scant; embryo straight; cotyledons foliaceous, folded.

A genus of about 40 species, native to the tropics of both hemispheres, exclusive Africa, but most abundant in America; only two species are at the present time reported from Panama.

a. Flowers erect, actinomorphous; calyx ca. 1.8-2.2 cm. long; gonophore ca. 2.7-3.5 cm. long, sparsely puberulous, the hairs simple and glandular; fruit 2.2-3 cm. long, glabrous at maturity .... 1. H. GUAZUMAEFOLIA
aa. Flowers horizontal, zygomorphous; calyx ca. 3 cm. long; gonophore ca. 8 cm. long, whitish-pubescent-arachnoid, the hairs stellate; fruit 4-5.5 cm. long, tomentose to puberulous .... 2. H. BARUENSIS

1. HELICTERES GUAZUMAEFOLIA H. B. K., Nov. Gen. Sp. Pl. **5**: 304. 1823.—Fig. 4.

Helicteres mexicana H. B. K., loc. cit. 305. 1823.
Helicteres carpinifolia Presl, Rel. Haenk. **2**: 138. 1835.
Helicteres Gardneriana St.-Hil. & Naud., Ann. Sci., Nat., Bot., ser. 2, **18**: 212. 1842.
Helicteres guazumaefolia var. *parvifolia* K. Schum. in Mart., Fl. Bras. **12**(3): 18, *t.4*. 1886.
Helicteres retinophylla R. E. Fries, Kungl. Sv. Vet.-akad. Handl. ser. 4, **42**(12): 23. 1908.
Helicteres guazumaefolia var. *Gardneriana* (St.-Hil. & Naud.) R. E. Fries, loc. cit. 25. 1908.

Shrub or small tree 1-4 m. high, the young branches arachnoid. *Leaves* shortly petiolate, the petiole 3-13 mm. long, arachnoid, the stipules subulate, ca. 6-8 mm. long, the blade ovate to elliptic, sometimes somewhat obovate, rounded to

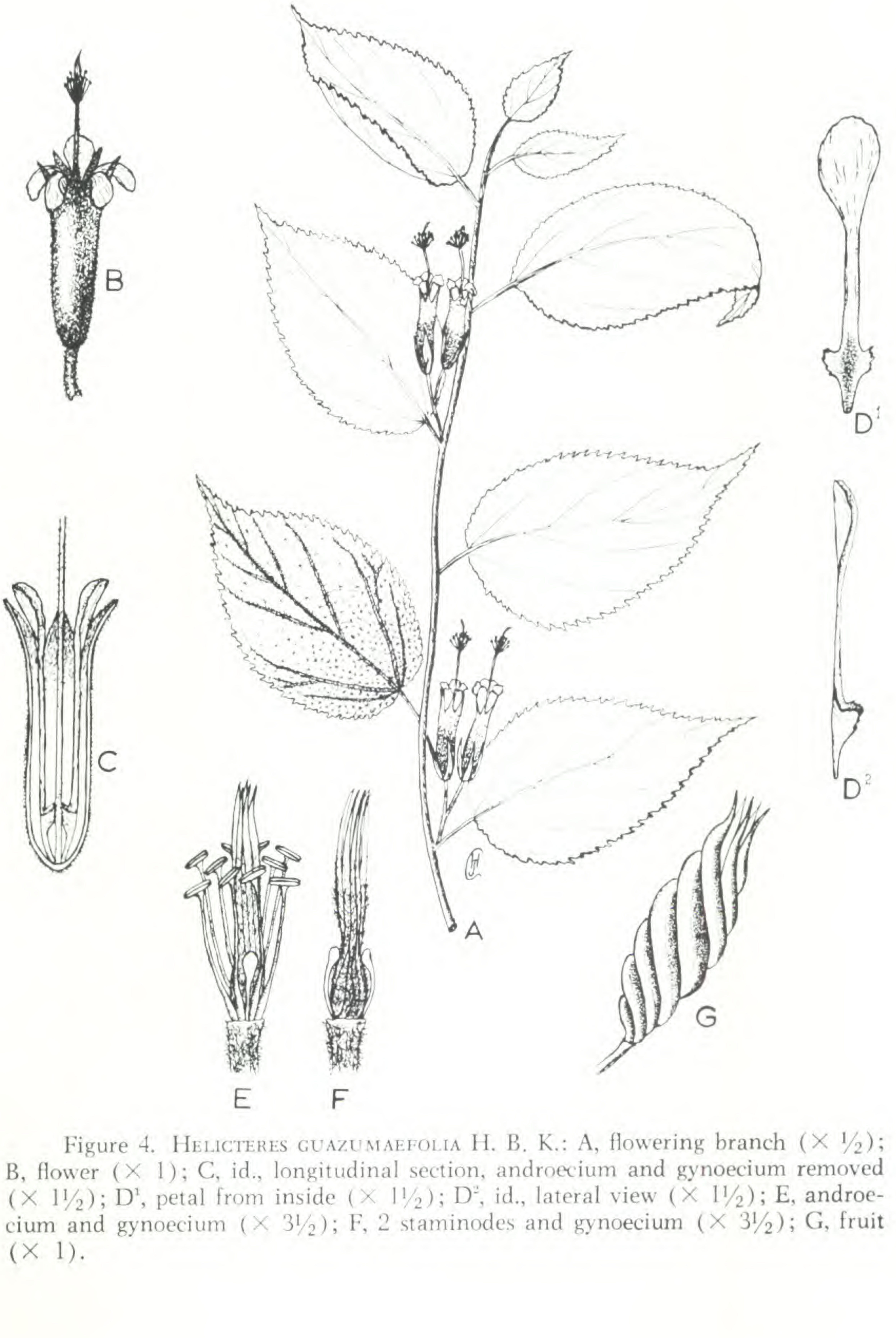

Figure 4. HELICTERES GUAZUMAEFOLIA H. B. K.: A, flowering branch (× ½); B, flower (× 1); C, id., longitudinal section, androecium and gynoecium removed (× 1½); D¹, petal from inside (× 1½); D², id., lateral view (× 1½); E, androecium and gynoecium (× 3½); F, 2 staminodes and gynoecium (× 3½); G, fruit (× 1).

more or less cordate at the base, more or less long-acuminate at the apex, 2-11 cm. long and 1-7 cm. wide, chartaceous, the margins serrate to doubly serrate, somewhat rugose and sparsely puberulous above, densely puberulous to tomentellous beneath, 3- to 7-nerved at the base, the nerves prominent beneath. *Inflorescences* axillary or oppositifolious, biflorus, the peduncle 0.5-1 cm. long and arachnoid. *Flowers* scarlet, erect, actinomorphic, the pedicel 2.5-3 mm. long, minutely arachnoid, the bracts lanceolate to oblong-lanceolate, slightly inaequilateral, acute to acuminate, 7-13 mm. long and 1.5-3.5 mm. wide, the margins entire to subentire and ciliate, puberulous on both sides; calyx ca. 18-22 mm. long and 5 mm. wide, the lobes 5, rarely 4, triangular, acuminate, unequal and ca. 4-5 mm. long, membranous, shortly villous outside, villous near the top inside; petals spatulate, the claw provided above the base with 2 winged and fimbrillate appendages, the apex asymmetric and rounded, unequal, ca. 21-24 mm. long and 3-7 mm. wide, glabrous; gonophore ca. 27-35 mm. long and 1 mm. wide, sparsely puberulous, the hairs simple and glandular; stamens 10, the filaments in 5 groups of 2, each pair very slightly connate at the base, ca. 2.5-4 mm. long, the anthers 1.8-2.5 mm. long; staminodes 5, ca. 2.5-3.5 mm. long and 0.5 mm. wide; ovary somewhat spirally twisted, ca. 1.5 mm. long and 1 mm. broad, villous; styles free, coalescent near the apex, ca. 6 mm. long, villous on the lower half, the stigmas acute. *Fruit* spirally twisted, 2.2-3 cm. long and 0.8-1.1 cm. broad, glabrescent at maturity, the accrescent gonophore 3-3.5 cm. long; seeds ovoid, 2-2.5 mm. long and 1.5-1.7 mm. broad, the testa slightly muricate.

From southern Mexico through Central America to Panama, West Indies and northern South America; dry or moist thickets, grassy or brushy slopes, clearings, often in second-growth vegetation.

CANAL ZONE: Gatun, *Hayes 142;* near Gatun, *Standley 27330;* along an old trail above the Reservoir, 1 to 3 miles from Gorgona, alt. 40-150 m., *Maxon 4750;* along trail between Gamboa and Cruces, alt. 50-80 m., *Pittier 3777;* Gamboa, *Bro. Heriberto 87;* Las Cruces trail, *Harvey 5038;* Obispo, *Standley 31761;* Empire to Mandinga, *Piper 5488;* vicinity of Summit, *Standley 30105;* Cerro Gordo, near Culebra, *Standley 25965;* Río Grande, near Culebra, alt. 50-100 m., *Pittier 2137;* Paraiso Station, *Hayes 28;* Chivi-Chivi trail, 2 miles above Red Tank, *Maxon & Harvey 6576, 6602;* between Miraflores and Corozal, alt. 20-30 m., *Pittier 2501;* Chiva-Chiva trail, Red Tank to Pueblo Nuevo, *Piper 5762;* Cocoli lighthouse, *P. White 93;* vicinity of Río Cocoli, Road K-9, *Stern, Chambers, Dwyer, Ebinger 17;* between Corozal and Ancon, alt. 10-30 m., *Pittier 6728;* road to Corozal, Ancon, *Bro. Celestine 33;* Ancon Hill, *Standley 25192, R. S. Williams 34, Woodson, Allen & Seibert 1323;* western slope of Ancon Hill, vicinity of Balboa, 20-75 m., *Seibert 402;* about 2 miles west of Balboa, *Correll 12271;* along drowned Río Azote Caballo, 66-70 m. *Dodge, Steyermark & Allen 16837;* locality unknown, *L. H. & E. Z. Bailey 556.* COCLÉ: above Penonomé, *R. S. Williams 279, 535;* vicinity of El Valle, 800-1,000 m., *Allen 97.* COLÓN: vicinity of Gatuncillo, *Piper 5630.* PANAMA: Cerro Campana, *Ebinger 369;* Capira, *Bro. Paul 130;* near Arraijan, ca. 15 m., *Woodson, Allen & Seibert 1356;* around Alhajuela, Chagres Valley, 30-100 m., *Pittier 3476;* Bella Vista, *Maxon & Valentine 6938, Standley 25379;* Camino de Las Sabanas, *Bro. Heriberto 180;* along Río Juan Díaz above Juan Díaz, about 30 m., *Allen 933;* between Matias Hernández and Juan Díaz, *Standley 32015;* near Tapia River, Juan Díaz region, *Maxon 6647;* Río Tapia, *Standley 28063;* near the big swamp east of Río Tocumen, *Standley 26707;* near Pacora River, *Miller 7180, 7181;* along road between Panama and Chepo, *Dodge, Hunter, Steyermark & Allen 16703;* roadside near Chepo, *Dodge 10724;* Laguna de Portala, alt. 50 m., *Pittier 4589,* Río Tatare, *Woodson & Schery*

997; Taboga Island, *Standley 28031;* Pedro Gonzalez Island, 0-20 m., *Allen 2595;* Pearl Islands, *Johansen 121.* VERAGUAS: trail between Cañazas and the foot of the Cordillera Central, headwaters of Río Cañazas, 300-600 m., *Allen 186.* PROVINCE UNKNOWN: *Hayes 346, 768.*

2. HELICTERES BARUENSIS Jacq., Enum. Syst. Pl. 30. 1760.

Shrub or slender tree 2-4 m. high, the young branches ferruginous-tomentose. *Leaves* shortly petiolate, the petiole thick, up to 1.5 cm. long, ferruginous-tomentose, the stipules subulate and 1-1.2 cm. long, the blade ovate, cordate at the base, acuminate at the apex, 6-14 cm. long and 5-9 cm. wide, chartaceous, the margins irregularly serrate or doubly serrate, shortly tomentellous above, tomentose-arachnoid beneath, 5- to 7-nerved at the base, the nerves impressed above and prominent beneath. *Inflorescences* axillary or oppositifolious, 3- to 5-flowered, the peduncle thick, ca. 1 cm. long, ferruginous-tomentellous. *Flowers* horizontal, zygomorphous, the pedicel ca. 5 mm. long, ferruginous-tomentellous, the bracts subulate, ca. 7-8 mm. long, ferruginous-tomentellous; calyx bilabiate, ca. 3 cm. long and 1 cm. wide, the lobes triangular, acuminate, unequal and ca. 1 cm. long, ferruginous-tomentellous outside, tomentose-arachnoid near the top inside; petals linear, long-unguiculate, the claw provided above the base with small appendages, rounded at the apex, ca. 4 cm. long, reddish; gonophore curved, ca. 8 cm. long, whitish-pubescent-arachnoid; stamens 10, the filaments ca. 3-4 mm. long, the anthers ca. 4 mm. long; staminodes 5, ca. 3 mm. long; ovary spirally twisted, ca. 3 mm. long and 1.5-2 mm. broad, whitish-villous, the styles coherent. *Fruit* cylindrical, spirally twisted, 4-5.5 cm. long and 1 cm. broad, the follicles dorsally canaliculate, tomentose to puberulous, the accrescent gonophore up to 10-12 cm. long; seeds flattened, ca. 2 mm. in diam.

Tropical Central America, Trinidad and northern South America; only one specimen, in fruit, is reported from Panama.

COCLÉ: Penonomé and vicinity, *R. S. Williams 450.*

5. THEOBROMA L.

By JOSÉ CUATRECASAS

THEOBROMA L., Sp. Pl. 782. 1753; Cuatrecasas, Contr. U. S. Nat. Herb. **35:** 449. 1964.

Cacao Mill., Gard. Dict. Abridg. ed. 4. 1754.
Tribroma Cook, Jour. Wash. Acad. Sci. **5:** 288. 1915.

Trees with primary branching 3- or 5-verticillate; further branching alternate; apical growth of the stem limited to the production of a whorl (jorquette) of 3-5 spreading, verticillate branches; continuing growth of the stem sympodial, by adventitious, subterminal shoots (below jorquette) (called chupons) or by pseudo-apical shoots (above jorquette) from buds axillary to the terminal verticillate branches. *Leaves* simple, long-petiolate and varied in phyllotaxy on the primary stem, short-petiolate and distichous on the lateral branches, penninerved or subpalmatinerved, persistent, coriaceous or subcoriaceous; pluricellular trichomes

usually as stellate hairs, rarely simple, sometimes glandular hairs. *Inflorescences* dichasial or monochasial, axillary or on reduced, tuberculiform branchlets on trunk and larger branches; pedicels articulate to bracteate peduncles. *Flowers* hermaphrodite; sepals 5, almost free and spreading or more or less united; petals 5, contorted, each one strangulated in 2 halves; lower part, corresponding to the claw, rigid and strongly veined with the shape of a hood; upper part a flat lamina, articulated to the inflexed apex of the claw; androecium in 2 whorls, united at base; outer whorl with 5 sterile, petaloid or linear staminodes opposite to the sepals; inner whorl with 5 fertile stamens opposite to the petals, the filaments short, shortly 2- to 3-branched, each branch with one anther; anthers hidden inside the petal-hoods, bithecate, the thecae unilocular and longitudinally dehiscent; pollen grains 3-colporate, peritreme, suboblate; gynoecium 5-carpellar, the ovary ovoid, pentagonal, 5-celled with axile placentation; ovules many, in two rows, anatropous with two integuments and dorsal raphe; styles 5, free or more or less united, filiform; stigmas apical, short, acute. *Fruit* large, subbaccate or subdrupaceous, indehiscent, the pericarp fleshy or hard and partly woody or coriaceous, the vascular axis thin and vanishing; seeds usually in 5 rows, each seed surrounded by a thick, fibrose, pulpy tissue filling the cavity at maturity, ovoid, ellipsoid or amygdaloid, the episperm double, thick, subcoriaceous, the other layer with a trichomatic and gelatinous epiderm developing into a thick, pulpy envelope; embryo straight; cotyledons thick, strongly plicate-corrugate; endosperm reduced to a filmy membrane covering the cotyledons; germination epigeous or hypogeous.

A neotropical genus of 22 species of small or medium-sized trees, many of them endemics, usually growing in the tropical rain forests.

Theobroma is important as a source of cacao beans which are produced mainly by one species, widely cultivated, *T. Cacao*.

In Panama five species are known to be found at present.

a. Leaves glabrous or puberulous beneath; jorquette 5-branched; petal-laminae stipitate, yellowish; staminodes narrowly subulate, red or purplish; stamens 2-antheriferous; fruit globose to fusiform and acute, more or less pentagonal or decagonal, glabrous, with carnose, relatively thick pericarp; flowers on trunk and on branches; growth below jorquette .... 3. T. Cacao

aa. Leaves densely stellate-tomentose beneath; jorquette 3-branched.

b. Leaves apparently glabrous and shining beneath, the indumentum, homotrichous, extremely minute and appressed in the areolae; inflorescences on trunk; petal-laminae sessile, crimson; staminodes lanceolate or subulate, purplish-red; stamens 2-antheriferous; fruit ellipsoid-oblong, more or less obtusely pentagonal, 15-20 x 6-7.5 cm., coriaceous; growth below jorquette .... 2. T. Bernoullii

bb. Leaves clearly tomentose beneath; inflorescences on branches.

c. Leaves elliptic-ovate or oblong-ovate, the lower surface silvery-greenish or cinereous, covered with a dense layer of uniform, stellate hairs; petal-laminae subsessile, red, brownish-red or purplish; staminodes linear-oblong, obtuse or subacute, brownish-red; stamens 2-antheriferous; fruit ellipsoid, 15-20 x 9-12 cm., with a thick-woody, strongly costate-reticulate and lacunose pericarp; growth below jorquette 3. T. bicolor

cc. Leaves obovate-oblong, elliptic-oblong or oblanceolate, heterotrichous beneath with dense, minute, whitish, stellate hairs and large, ochraceous or ferruginous, stellate hairs on the nerves; petal-laminae stipitate; staminodes oblong-obovate; stamens 3-antheriferous; pericarp coriaceous; growth above jorquette.

d. Petal-laminae and staminodes yellow; fruit oblong-ellipsoid or ovoid-ellipsoid, umbilicate and 5-costate at base, slightly attenuate at apex, 10-18 x 6-9 cm., tuberculate-rugose; leaves cinereous beneath, the nerves with large, ochraceous, stellate hairs, these with long, spreading rays .... 4. T. ANGUSTIFOLIUM

dd. Petal-laminae and staminodes brownish-red; fruit ellipsoid, rounded at both ends, about 7 x 4 cm., smooth; leaves cinereous beneath, the nerves with thick, ferruginous, stellate hairs, these with short rays .... 5. T. HYLAEUM

1. THEOBROMA BICOLOR Humb. & Bonpl., Pl. Aequin. **1:** 104, *pl. 30.* 1806; Cuatrecasas, Contr. U. S. Nat. Herb. **35:** 458, *figs. 2, 5, 9, 12, 18, 35, map 3.* 1964.

Theobroma ovatifolia Moç. & Sesse ex DC., Prodr. **1:** 485. 1824; Icon. Fl. Mex. ex DC. *pl. 113.*
Cacao bicolor (Humb. & Bonpl.) Poir. in Lam., Encycl. Méth. Bot. Suppl. **2:** 7. 1811.
Tribroma bicolor (Humb. & Bonpl.) Cook, Jour. Wash. Acad. Sci. **5:** 288. 1915.

Tree usually 3-8 m. tall, up to 25-30 m. in high forest, with rather narrow crown; growth below jorquette; trunk erect with light bark and white wood; primary branches ternate, dichotomous, spreading, horizontal or pendulous, subterete, densely and appressed-cinereous-tomentose with minute, stellate hairs; older branches glabrate, smooth, gray; stipules oblong-lanceolate, minutely appressed-tomentose, more or less persistent. *Leaves* with a petiole rather thick, subterete, 12-25 mm. long, minutely appressed-tomentose; blade oblong-ovate or elliptic-ovate, cordate or emarginate, asymmetrical at base, attenuate, abruptly acuminate at apex, entire or rarely sinuate at the upper margin, 12-34 cm. long and 6-18 cm. broad, the acumen triangular and 6-12 mm. long, firmly chartaceous, subpalmatinerved; upper surface green, glabrous or with scattered hairs, the main nerves noticeable, the lesser slightly conspicuous; lower surface silvery-greenish or cinereous, covered with a dense layer of intricate, stellate hairs, 5- to 7-nerved at base, the thicker costa and 2 or 3 main nerves on each side strongly prominent; leaves on primary stem and chupons larger, symmetrical, deeply cordate, 30-50 cm. long and 21-36 cm. broad, with a petiole 10-38 cm. long. *Inflorescences* axillary or extra-axillary on leafy, juvenile branchlets, usually 3-6 cm. broad, with short axis and divaricate, dichasial and cincinnate branching, densely ochraceous- or cinereous-tomentose; pedicels 3-6 mm. long; bracteoles 1.5-2.5 mm. long, densely and minutely tomentose; buds oblong-ovate, subacute, minutely cinereous- or ochraceous-tomentose. *Flowers* with spreading, lanceolate or ovate-lanceolate sepals, these shortly connate at base, acute at apex, 5-6 mm. long and 2-2.5 mm. broad, subappressed-stellate-tomentose and reddish outside, 3-nerved and sparsely pilose inside; petal-hoods oblong-obovate, rounded-cucullate with incurved apex, 2-2.5 mm. long and 1-1.2 mm. broad, submembranaceous, whitish-rosy or reddish with a darker midrib, hirtellous-pubescent with a depressed, tomentellous midrib outside, glabrous with a thick, trifurcate midrib inside; petal-laminae ovate, abruptly contracted at base in a short nail, rounded at apex, 1-1.2 mm. long and 0.8 mm. broad, carnose, red.

brownish-red or purplish, hirtellous-pubescent; staminodes linear-oblong, slightly narrowed at base, obtuse or subacute at apex, 3.5-4.5 mm. long and 0.6-0.8 mm. wide, carnose, brownish-red, covered with minute, thickish, patulous hairs; filaments about 1-1.5 mm. long, glabrous, 2-antheriferous; ovary velutinous-tomentose; styles united, rigid, whitish. *Fruit* subglobose-ellipsoid or oblong-ellipsoid, 15-20 (10-25) cm. long and 9-12(-15) cm. broad, green, when ripe yellow or brownish; pericarp hard, woody, 7-15 mm. thick, densely stellate-pilose, strongly 10-costate, the deep furrows reticulate, deeply lacunose; pulp fibrose, yellowish, sweet, scented; seeds complanate, ovoid-amygdaliform, 16-30 mm. long, 14-23 mm. wide and 8-13 mm. thick; embryo white; germination epigeous.

Theobroma bicolor probably originated in Central America. It is found in cultivation, in limited extension, throughout tropical America. It is a very distinctive species, easy to recognize by its small, lax, horizontal crown, by its large, papery, cinereous, pendulous leaves and by the thick, woody, carved shell of its ellipsoid fruits. These remain green until ripening, when they change the color into yellow or brownish, falling from the tree.

The common name in Panama is *pataste;* in Darien, the Choko Indians call it *cu-lu-hu,* according to *Allen 4539.*

The seeds are locally used like those of cacao, giving a chocolate of inferior quality. Although the pulp does not have a very attractive flavor, it is sucked by the natives and used in the preparation of refreshments.

BOCAS DEL TORO: Laguna de Chiriqui and its neighborhood, Pope's Island, *Hart 158* (US). CANAL ZONE: Caño Quebrado, *Pittier 6883* (GH, NY, US). DARIEN: headwaters of Río Chica, 500-750 ft., cultivated by Choko Indians, *Allen 4539* (G, MO, NY).

2. THEOBROMA BERNOULLII Pittier, Repert. Sp. Nov. **13:** 319. 1914; Cuatrecasas, Contr. U. S. Nat. Herb. **35:** 489, *figs. 15-17, 19, map 4.* 1964.

Tree 15-20 m. high; growth below jorquette; primary branches ternate, dichotomous, the terminal leafy, terete, dark brown, subappressed-tomentulose, when older puberulous or glabrate; stipules linear-oblong, acute, pubescent. *Leaves* with a petiole thick, terete, 5-10 mm. long, densely and minutely tomentulose; blade elliptic-oblong, obtusely cuneate-attenuate and asymmetrical at base, narrowed toward the apex, ending in a long, linear acumen, entire or very slightly sinuate, 13-28 cm. long and 5-8 cm. broad, the acumen 1-3 cm. long, thin-coriaceous, triplinerved; upper surface green and glabrous, the main nerves filiform and prominent, the others reticulate and slightly prominulous; lower surface pale-greenish-ochraceous or ashy, apparently glabrous but the tawny, shining veins with very sparsely minute, stellate hairs and the areolae covered with a very appressed, white tomentum of smaller, microscopic, entangled, stellate hairs, the midrib and 6-7 secondary nerves on each side very prominent. *Inflorescences* on the main trunk usually many-flowered, borne on short, tuberculate, woody branches; panicles corymbiform, 4-10 cm. long, the axes cymose-bifurcate in the upper third or rarely from the base, the branchlets rigid, erect at acute angle; peduncles capillary, 3-

bracteolate at apex; bracteoles narrowly linear, 1-2 mm. long, very soon deciduous; pedicels thicker than the peduncles, minutely stellate-tomentellous like the branchlets; buds ovoid, densely tomentose. *Flowers* with lanceolate-oblong sepals, these shortly united at base, rather acute at apex, 8-10 mm. long and 3 mm. wide, moderately thick, reddish and with sparse, slender, flexuous, sericeous hairs inside, ferruginous and stellate-tomentose outside, with thick, glandular hairs at the insertion at base; petal-hoods oblong-obovate, rounded-cucullate at apex, 4-5 mm. long and about 2 mm. wide, 0.6 mm. wide at base, red, hirtellous-pubescent outside, prominently 3-nerved inside; petal-laminae sessile, round or elliptic, shortly unguiculate-articulate, minutely crenulate, 2.5-4 mm. long and 3-4 mm. broad, moderately thick, crimson, rugulose, glabrous; staminodes sublanceolate-linear-subulate, 6-10 mm. long, thick, purplish-red, covered with minute, spreading, acute, conical hairs; filaments about 2.5 mm. long, glabrous, 2-antheriferous; ovary tomentose; styles adherent into a column but separable. *Fruit* ellipsoid-oblong, more or less obtusely 5-angulate, umbilicate at base, abruptly narrowed and subacute or subobtuse at apex, 15-20 (12-25) cm. long and 6-7.5 (5.2-8) cm. broad, the pericarp thick, dull brown, velvety-tomentose, coriaceous at maturity, shrinking in drying; pulp white, flavored, acidulous; seeds compressed-ovoid, 16-22 x 9-14 x 9-11 mm., the testa reddish, papery; germination epigeous, the cotyledons white.

T. Bernoullii, broadly considered, includes three heteromorphic elements, two from the Atlantic coast of Panama and the subsp. *capilliferum* (Cuatr.) Cuatr. from the Pacific coast of Colombia. For further discussion, see my Revision of the genus *Theobroma*, Contr. U. S. Nat. Herb. **35**: 491. 1964.

2a. THEOBROMA BERNOULLII subsp. BERNOULLII; Cuatrecasas, loc. cit. 492. 1964.

Peduncles 2-5 mm. long; pedicels 5-8 mm. long; petal-hoods 4-5 x 2-2.5 mm.; petal-laminae suborbicular, 3 x 3-4 mm. long; staminodes lanceolate, 5.5-6 mm. long, 1.5-2 mm. broad at base, slightly pilose; fruit unknown.

COLÓN: Fato, Loma de la Gloria (Nombre de Dios), selvas, 10-104 m. alt., *Pittier 4105* (US, holotype; BM, BR, C, F, GH, K).

2b. THEOBROMA BERNOULLII subsp. ASCLEPIADIFLORUM (Schery) Cuatrecasas, loc. cit. 493. 1964.

Theobroma asclepiadiflorum Schery, Ann. Missouri Bot. Gard. **29**: 360. 1942.

Peduncles 6-12 mm. long; pedicels 10-12 mm. long; petal-hoods 5 x 3 mm.; petal-laminae elliptic, 4 x 3 mm.; staminodes subulate, 9-10 mm. long and 1.5 mm. broad, densely pilose; fruit ellipsoid-oblong, slightly pentagonal, not attenuate above the base, attenuate at apex, 17 x 7 cm., with a filiform, impressed furrow on each obtuse, inconspicuous ridge.

BOCAS DEL TORO: Water Valley, *Allan Lucas 1* (F, TURRI), *von Wedel 681* (MO, US), *1535* (MO).

3. THEOBROMA CACAO L., Sp. Pl. 782. 1753; Cuatrecasas, Contr. U. S. Nat. Herb. **35:** 495, *figs. 1-6, 20-26, pl. 6, map 6.* 1964.

Theobroma pentagonum Bernoullii Uebers. Art. *Theobroma* 6-7, *pl.* 2. 1869.
Theobroma leiocarpum Bernoulli, loc. cit. 6, *pl.* 2. 1869.
Theobroma sphaerocarpum Chev., Végét. Util. Afr. Trop. Fr. **4:** 12. 1908.
THEOBROMA CACAO subsp. CACAO; Cuatrecasas, loc. cit. 513. 1964.
THEOBROMA CACAO subsp. SPHAEROCARPUM (Chev.) Cuatrecasas, loc. cit. 515. 1964.

Tree usually 4-8 m. high, rarely taller and up to 20 m.; growth below jorquette; primary branching quinate; young branchlets terete, grayish-green or brownish, densely or sparsely pubescent with slender, patulous, acute, simple or furcate hairs, later glabrate, rugulose and sparsely lenticellate; stipules subulate, deciduous. *Leaves* alternate, distichous, the petioles thickened-pulvinate at both ends, 1.5-2 (1-3) cm. long, on orthotropous stems 3-10 cm. long, pubescent or tomentose with slender, spreading, acute, simple hairs; blade subobovate-oblong or elliptic-oblong, slightly asymmetrical, rounded or obtuse at base, attenuate and acuminate at apex, entire or slightly and irregularly sinuate, 15-50 cm. long and 4-15 cm. broad, coriaceous or chartaceous, the acumen acute or subacute and 1-2.5 mm. long; upper surface green, glabrous except for the pubescent or puberulous, prominent costa, the secondary nerves filiform; lower surface lighter green, glabrous or with very sparse, minute, simple, furcate or stellate hairs, rarely puberulous, the costa prominent, the 9-12 secondary nerves on each side prominent, subpatulous. *Inflorescences* on the trunk and on the branches, usually borne on small tubercles, the cymose peduncles 1-3 mm. long, stellate-pubescent, hirtellous and with scattered, glandular hairs; bracts and bracteoles ovate or ovate-oblong, acute or subacute, pubescent, deciduous; pedicels capillary, rigid, 5-15 mm. long, pale green, whitish or reddish, hirtellous with patulous, stellate or furcate hairs and glandular, capitate hairs; buds ovoid or oblong-ovoid, acute, white, whitish-green, lilac or reddish, subglabrous or sparsely puberulous. *Flowers* with lanceolate or oblong-lanceolate sepals, these shortly united at base, acute at apex, 5-8 mm. long and 1.5-2 mm. wide, thick-membranaceous, white, greenish-white, pale violaceous or reddish, slightly 3-nerved, glabrous or with stellate and glandular hairs outside, glabrous or with rare, glandular hairs inside; petals thick-membranaceous; petal-hoods obovate, rounded at apex, 3-4 mm. long and 5-2 mm. wide, white, 3-nerved; petal-laminae stipitate, the stipe linear and 2-4 mm. long, obovate or rombic-obovate, the apex attenuate, acuminate or subtruncate and shortly mucronate, rarely blunt, the margin entire or sinuate, 1.5-2.5 mm. long and 1.5-2 mm. wide, pale yellowish; staminodes narrowly subulate, very acute, 4-6 mm. long, the middle vein thick, angular, red or purplish, minutely papillose-pilose, the thin margin whitish, ciliate with slender, flexuose, simple hairs; filaments 1.5-2 mm. long, glabrous, 2-antheriferous; ovary glabrous or usually glandular, the glands numerous, stipitate, white or reddish, pluricellular; styles adherent, glabrous. *Fruit* variable in shape, from globose to fusiform and acute, with a very smooth to a strongly ridged and rugose or verrucose surface; pericarp consistently fleshy, 5-15 mm. thick, usually made of 2 more or less conspicuously different, carnose layers (epicarp and endocarp) separated by a thin, ligneous membrane (mesocarp), the latter sometimes reduced to isolated

bundles of fibers or lacking, the endocarp also sometimes lacking; pulp white and sweet; seeds 20-40, ovoid, ellipsoid, amygdaloid, more or less complanate or almost round in cross-section, variable in size, 20-40 mm. long and 12-20 mm. broad, the testa subcoriaceous, brown; cotyledons white, purplish, violet or intermediate in color.

A polymorphic species, especially with regard to the color, size and shape of the parts of the flower and the fruits. Several species and varieties have been described based on these variations, the most significant are those related to the shape of the fruit and to the color of the cotyledons. Two main underspecific groups may be considered: in one group the fruits are more or less angulate, verrucose, gradually elongate and narrowed to the acute apex, and the cotyledons are white; in the other group the fruits are obtuse and smooth with shallow furrows, and the cotyledons are purplish. The first group comprises the commercially known *criollo* cacaos, which produce the best quality of cacao beans. Probably this type of cacao, since ancient times widely spread in Central America, represents the form of the original species described by Linnaeus. To the second group, of South American origin, belong the commercially known *forastero* cacaos, which can be classified under the subsp. *sphaerocarpum.* Cultivars of both groups of cacao may be found in Panama as well as in many other tropical countries.

T. Cacao originated in Central and South American rain forests, but is now cultivated throughout the humid tropics of the world. Being the source of the cacao beans, it is one of the most important tropical crops of the world.

In Panama, *T. Cacao* is cultivated in more or less extension in the lowlands of all parts of the country. It may also be found spontaneous or wild in the rain forests, but the lack of good collections prevent me from identifying the varieties and from speculations on the role played by the Isthmus of Panama in the origin and evolution of cacao. The common Panamanian name is *cacao.* For further information concerning infraspecific taxa, typification, etc., see my Revision of the genus *Theobroma*, Contr. U. S. Nat. Herb. **35:** 495-517. 1964.

No citations of specimens are given because the existing collections are lacking fruits and flowers and do not have much significance.

4. THEOBROMA ANGUSTIFOLIUM Moç & Sesse ex DC., Prodr. **1:** 484. 1824; Icon. Fl. Mex. ex DC., *pl. 112;* Cuatrecasas, Contr. U. S. Nat. Herb. **35:** 526, *figs.* 6, 25, *29-31, 37, map 8.* 1964.

Tree 8-26 m. high; trunk up to 30 cm. in diam., with smooth bark and whitish wood; growth above jorquette; primary branches ternate; lower branches horizontal, the higher ascending; branchlets green-ochraceous, tomentose with very minute, fine, translucid-white and other mediocre, fulvous or ochraceous, thicker, stellate hairs, when older grayish, more or less glabrate and rugulose; stipules lanceolate-subulate, stellate-tomentose, deciduous. *Leaves* distichous, the petioles moderately thick, 6-10 mm. long, tomentose; blade subobovate-oblong, elliptic-oblong or oblanceolate, slightly narrowed to the obtuse and slightly asymmetrical base, atten-

uate and acuminate at apex, entire or at the upper part slightly sinuate-dentate, 9-25 cm. long and 3-9 cm. broad, chartaceous, rather flexible, the acumen 1-2 cm. long; upper surface smooth, glabrous or with few hairs scattered on the depressed, filiform costa, the other nerves less conspicuous; lower surface greenish or cinereous, appressed-tomentose with minute, white, stellate hairs, the main nerves with larger, ochraceous, stellate hairs, these with long, spreading rays, the costa very prominent, the 6-8 secondary nerves on each side prominent, ascending. *Inflorescences* axillary or extra-axillary, usually abundant on the branchlets, the cymes reduced to few 1- to 3-flowered branchlets; peduncles 0.4-1 mm. long, 3-bracteolate; bracteoles, linear, very minute, deciduous; pedicels 5-10 mm. long, densely ochraceous or ferruginous, ebracteate; buds globose, densely ochraceous-tomentose. *Flowers* with a calyx 8-9 mm. long, reflexed at anthesis, the sepals ovate, rather obtuse, 4-5 mm. wide, united to 3-4 mm. into a cupular base, in the upper part united by pairs forming 3 unequal lobes, tomentose and greenish-ochraceous or ferruginous outside, scarsely puberulous and with minute, oblong, glandular hairs at the base inside; petal-hoods broadly obovate, rounded-cucullate at apex, about 5 mm. long and 4 mm. broad, yellowish, 7-nerved and with very sparse, thin hairs outside; petal-laminae stipitate, the stipe linear and about 4-5 mm. long, subobovate-spatulate, attenuate toward the base, emarginate at apex with 2 ovate or rounded lobes, about 5.5 mm. long and 3 mm. broad, thick-membranous, yellow, glabrous; staminodes laminar, oblong-obovate, rounded or subspatulate at apex, 8-11 mm. long and 4.2-5 mm. broad, 1.2 mm. broad at base, thick-membranous, sulphur yellow. glabrous, with marked venation; filaments 2 mm. long, glabrous, 3-antheriferous; ovary densely stellate-tomentose; styles united into a rigid, erect column ending in 5 slender branches. *Fruit* unequally oblong-ellipsoid or ovoid-ellipsoid, more or less pentagonal, umbilicate and 5-costate at base, slightly attenuate at apex, 10-18 cm. long and 6-9 cm. broad, brown-tomentose, very irregularly tuberculate-rugose, the epicarp ligneous and about 1.5 mm. thick; pulp thick, juicy, aromatic, edible; seeds compressed-oblong-ovoid, 26-32 x 16-19 x 14-16 mm.; germination hypogeous, the cotyledons white.

T. angustifolium is native to tropical Central America, where it is often planted in lowland areas. In Chiriquí, it is called *cacao cimarrón*. Its seeds are occasionally used as cacao, although it is considered as of inferior quality. The herbarium specimens from Panama are sterile.

CHIRIQUÍ: Progreso, *Cooper & Slater 242* (F, GH, NY, US, Y); Comarca del Barú, Puerto Armuelles, United Fruit Co. farms between Canasco and Cocos, *Stern & Chambers 140* (MO, US, Y).

5. THEOBROMA HYLAEUM Cuatrecasas, Contr. U. S. Nat. Herb. **35:** 570, *figs.* 25, 39, *map 11.* 1964.

Tree about 10 m. high; growth above jorquette; primary branches ternate; leafy branches brownish, the hornotinous ferruginous-tomentose becoming glabrate; stipules linear-subulate. *Leaves* with a petiole 6-10 mm. long, ferruginous-tomentose; blade elliptic-oblong or obovate-oblong, attenuate near the obtuse or subob-

tuse, symmetrical base, shortly narrowed or almost rounded and abruptly acuminate at apex, entire or upwards sinuate, 12-20 cm. long and 4-9 cm. broad, coriaceous, moderately rigid, the acumen 6-15 mm. long; upper surface brownish-green, glabrous, the main nerves thinly impressed, the others almost inconspicuous; lower surface ochraceous-cinereous, tomentose with dense, intricate, minute, whitish, stellate hairs and thicker, ferruginous, stellate hairs especially on the nerves, the costa very prominent, the 7-8 secondary nerves on each side prominent, ascending. *Inflorescences* axillary, very small, reduced to 1-3 flowers, the axes and branchlets very short; peduncles slender, up to 12 mm. long, ferruginous-tomentose, 3-bracteolate at apex; bracteoles narrowly linear, subacute, 3-6 mm. long and 1-2 mm. broad, tomentose; pedicels 5-6 mm. long, tomentose. *Flowers* with ovate-oblong sepals, these united about 2 mm. from the base, acute and spreading or reflexed at apex, 8-9 mm. long and 4-5 mm. broad, thick, ochraceous-tomentose outside, orange and glabrous except for the minutely tomentose margin and for a ring of glandulous hairs at base inside; petal-hoods obovate, rounded-cucullate at apex, 3 mm. long and 2 mm. broad, orange, 7-nerved, glabrous and rugose outside, minutely hispidulous inside; petal-laminae stipitate, the stipe 2.5 mm. long and sparsely puberulous, rhomboid-obovate, 4-5 mm. long and 4 mm. broad, thick, brownish-red, sparsely covered with minute hairs, the margin with larger, flexuose hairs; staminodes petaloid, oblong-obovate, rounded and retuse at apex, 5-5.5 mm. long and 2.2 mm. broad, rather thick, brownish-red, minutely pilose; filaments 1 mm. long, 3-antheriferous; ovary densely tomentose; styles coherent, 1 mm. long, glabrous. *Fruit* ellipsoid, rounded at both ends, about 7 x 4 cm., smooth, greenish-brown, densely appressed-tomentose, the epicarp woody-coriaceous, about 1 mm. thick when dry.

T. hylaeum is closely related to *T. subincanum* Mart., the widespread Amazonian and Orinocian species; it differs, however, in the tomentose ovary and by the smaller, shorter fruit and by the lesser venation and the more compact hairs of the leaves.

T. hylaeum is known from Chocó region of northern Antioquia in Colombia. This region is covered with rain forests extending northwards along the Atlantic coast to Panama. The only Panamanian specimen seen by me is sterile, but I have little doubt about this identification.

COLÓN: along Río Fató, in forests or thickets, 0-100 m. alt., *Pittier 4194* (US).

6. HERRANIA Goudot

HERRANIA Goudot, Ann. Sci. Nat., Bot., ser. 3, **2**: 230. 1844.

Shrubs or small trees, the pubescence of stellate hairs. *Leaves* alternate, compound-digitate, petiolate, stipulate, the stipules caducous or sometimes persistent, the leaflets inarticulate, entire or not, penninerved. *Inflorescences* cauliflorous, fasciculate. *Flowers* hermaphrodite, actinomorphous, pedicellate, bracteolate; calyx patelliform or cymbiform, divided more or less deeply into 3, rarely 4 lobes at anthesis; petals 5 (sometimes 4?), valvate, cucullate, the apex involute and

provided with an extraordinarily elongate liguliform appendage; stamens usually 15, the staminal tube short, divided into 5 alternipetalous, petaloid staminodes and 5 oppositipetalous groups of generally 3 short filaments; anthers 2-thecate, the thecae divergent, extrorse, longitudinally dehiscent; ovary sessile, globose to ovoid, 5-celled, the cells many-ovulate, the ovules biseriate; style filiform; stigma obscurely 5-fid. *Fruit* baccate, coriaceous to ligneous, longitudinally 10-costate, indehiscent, pulpy inside; seeds obtusely angulate, the albumen scanty; embryo erect; cotyledons thick, corrugate.

A neotropical, chiefly South American genus of about 20 species; only one species occurs in Panama and in Central America.

1. HERRANIA PURPUREA (Pittier) R. E. Schultes, Caldasia **2**: 33. 1944.—Fig. 5.

Theobroma purpureum Pittier, Repert. Sp. Nov. **13**: 319. 1914; Standley, Contr. U. S. Nat. Herb. **27**: *pl. 51.* 1928

Shrub or small tree, up to 10 m. high, the bark grayish and glabrous; young branches ferruginous-tomentellous. *Leaves* 5-foliolate, the petiole strong, terete, striate, somewhat swollen at the base, 18-42 cm. long, tomentellous to densely puberulous, the stipules linear, acute, up to 5 cm. long and 0.3 cm. wide, puberulous and caducous; leaflets subsessile, obovate to obovate-oblong, cuneate at the base, obtusely long-acuminate and mucronulate at the apex, 12-42 cm. long and 3-13 cm. wide, thin-chartaceous, the margin entire to obscurely sinuate, glabrous above except along the nerves, sparsely puberulous beneath, the nerves prominent on both sides but especially beneath. *Inflorescences* cauliflorous on the lower part of the trunk, 5- to 8-flowered. *Flowers* shortly pedicellate, the pedicel terete, articulate, ca. 4 mm. long, ferruginous-tomentose, the bracts small, naviculiform, ferruginous-tomentose outside and glabrous inside; calyx patelliform, deeply divided into 3, rarely 4 lobes, the lobes unequal, broadly ovate, rather obtuse at the apex, densely ferruginous-puberulous to tomentose outside, sparsely villous inside; petals 5, obovate, up to 8 mm. long (without appendage) and 4-5 mm. wide, fleshly, purplish, loosely papillate, the pendulous appendage ca. 15 mm. long and 2 mm. wide; stamens 15, the staminal tube ca. 2.5-3 mm. long, the filaments in 5 groups of 3, in each group 1 free and 2 connate filaments ca. 2 mm. long; anthers ca. 1 mm. long; staminodes obovate, rounded to acute at the apex, 9-11 mm. long and 8 mm. wide, papillate on both sides; ovary ovoid, slightly 10-sulcate, 2-2.5 mm. long and 2 mm. broad, villous; style short, ca. 1.5 mm. long, glabrous; stigma villous. *Fruit* ellipsoid, oblong-ellipsoid or slightly oblong-obovoid, somewhat apiculate at the apex, 6-10 cm. long and 2.5-4 cm. broad, yellow, very sparsely hispid to glabrescent and with stinging hairs outside; seeds obtusely rhomboid, ca. 1-1.3 cm. long, 0.7-1 cm. wide and 0.5-0.6 cm. long.

Costa Rica and Panama, usually in wet forests; called *cacao cimarrón* and *chocolatillo* in Panama.

BOCAS DEL TORO: Changuinola Valley, *Cooper & Slater 12a, Dunlap 448;* Farm 6a, between Changuinola and Sixaola Rivers, *Rowlee & Stork 1029;* Chiriquí Lagoon, *Hart 96, von Wedel 1112;* Water Valley, *von Wedel 976, 1781.* CANAL ZONE: near Fort Randolph, *Standley 28647;* Cristobal, *Cook & Martin 4;* Monte Lirio, *Hayes 398;* along the Río Indio

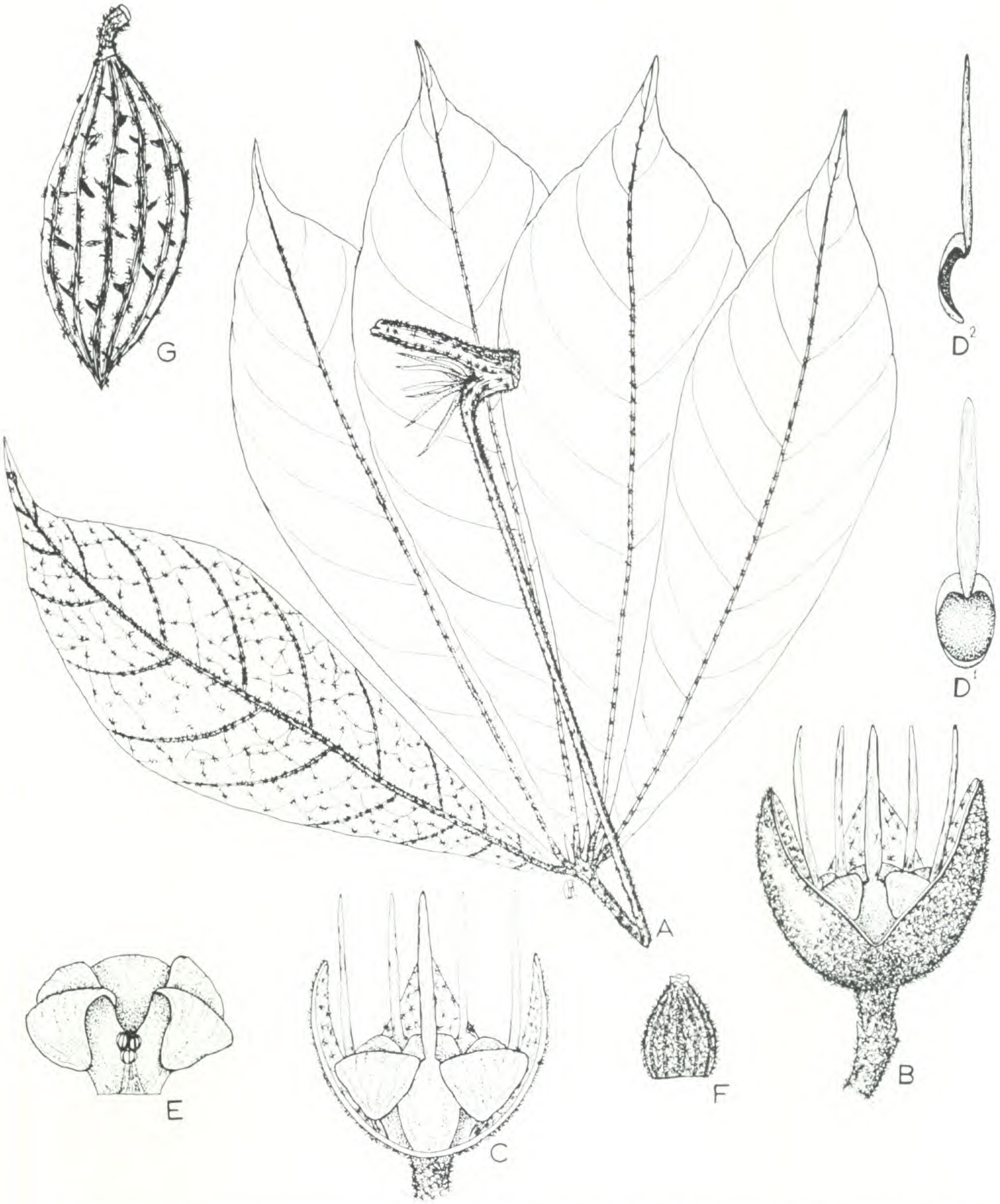

Figure 5. HERRANIA PURPUREA (Pittier) R. E. Schultes: A, leaf (× 1/4); B, flower (× 1½); C, id., one half of calyx removed (× 1½); D1, petal from inside (× 1½); D2, id., lateral view (× 1½); E, androecium (× 1½); F, ovary (× 5); G, fruit (× 1/2).

de Gatun, near sea level, *Maxon 4835;* Barro Colorado Island, *Bangham 549, Kenoyer 443, Maxon, Harvey & Valentine 6804, Shattuck 198, Standley 31319, 40911, Wetmore & Abbe 73;* hills north of Frijoles, *Standley 27434;* near Madden Dam, near sea level, *Alston 8861;* Gamboa, *Standley 28416;* Obispo, *Standley 31722;* Valley of Masambi, on the road to Las Cascadas Plantation, alt. 20-100 m., *Pittier 2675;* around El Paraiso, alt. 30-100 m., *Pittier 2574* (type). CHIRIQUÍ: Progresso, *Cooper & Slater 283.* DARIEN: Marraganti and vicinity, *R. S. Williams 662;* trail between Pinogana and Yavisa, alt. ca. 15 m., *Allen 282;* vicinity of Yaviza, along Río Chucunaque, in woods by Interamerican Hwy., between Pinogana and Yaviza, 1 km. from Tuira, *Stern, Chambers, Dwyer, Ebinger 137;* vicinity of Caná, 900 m., *Goldman 1974.* PROVINCE UNKNOWN: *Hayes 399.*

7. BYTTNERIA Loefl.

BYTTNERIA Loefl., Iter Hisp. 313. 1758.

Pentaceros G. F. W. Meyer, Primit. Fl. Essequeboensis 136. 1818.

Undershrubs or shrubs, erect or scandent, sometimes lianas, the stems often aculeate, glabrous or with simple or stellate hairs. *Leaves* alternate, simple, petiolate, stipulate, the stipules caducous, the blade entire or not. *Inflorescences* axillary, usually umbelliform, sometimes of sessile or pedunculate, axillary or subterminal cymes. *Flowers* small, hermaphrodite, actinomorphous, pedicellate, bracteolate; calyx deeply 5-lobate, deciduous; petals 5, valvate, the limb concave, unguiculate, lobulate or not at the apex, the apex inflexed and adnate to the androecium, prolonged dorsally into an elongate, simple or 3-fid appendage; stamens 5, the staminal tube short, the sessile or short-stipitate anthers oppositipetalous, the 5 staminodes alternipetalous; anthers 2- or 3-thecate, the thecae parallel, extrorse, longitudinally dehiscent; ovary sessile, 5-celled, each cell 2-ovulate; style simple, short; stigma 5-fid or entire. *Capsule* globose, spinose, the carpels separating at maturity into 5 cocci, each coccus dehiscent along the ventral suture and along the dorsal upper half, 1-seeded; seeds ascending, exalbuminous; embryo straight; cotyledons large, foliaceous, spirally convolute around the radicle.

A pantropical genus of about 90 species, especially well represented in tropical America (about 50 species) and in Madagascar (27 native species).

1. BYTTNERIA ACULEATA Jacq., Select. Stirp. Am. Hist. 76. 1763.—Fig. 6.

Chaetaea aculeata Jacq., Enum. Syst. Pl. 17. 1760, nom.nud.
Byttneria carthagenensis Jacq., Select. Stirp. Am. Hist. Pict. 40. 1780.
Byttneria lateralis Presl, Rel. Haenk. **2:** 144. 1835.
Byttneria guatemalensis Loes., Verh. Bot. Ver. Prov. Brandenb. **55:** 171. 1913.

Scandent shrub, sometimes liana, the hairs simple, the stems and branches more or less angular, hollow, pilose along one vertical row and aculeate, the prickles sharp and recurved. *Leaves* with a petiole 0.5-4.5 cm. long, pilose on the adaxial side, sparsely and shortly aculeate on the abaxial side, the blade very variable, rounded-ovate to narrowly lanceolate, obtuse to cordate at the base, acute to long-acuminate at the apex, 4-18 cm. long and 1.2-13 cm. wide, thin and membranous, the margins entire or remotely serrate, sparsely pilose to glabrous on the upper surface, pilose especially near the base and with the midrib sparsely and shortly aculeate on the lower surface. *Inflorescences* axillary, umbelliform,

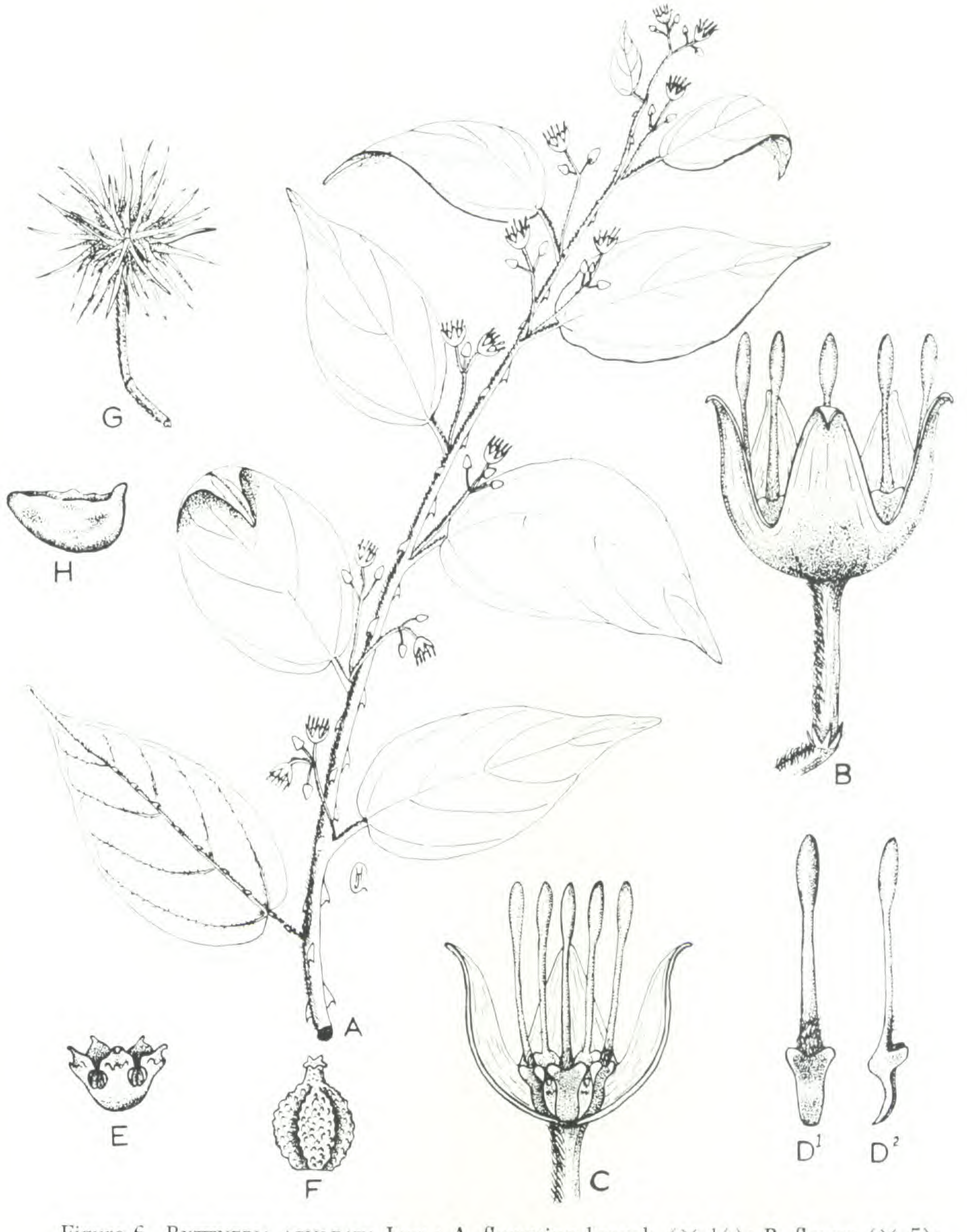

Figure 6. BYTTNERIA ACULEATA Jacq.: A, flowering branch (× ½); B, flower (× 5); C, id., one half of calyx removed (× 5); D¹, petal from inside (× 6); D², id., lateral view (× 6); E, androecium (× 10); F, gynoecium (× 20); G, capsule (× 1); H, seed (× 5).

few-flowered, pedunculate, the peduncles pilose, the hairs generally uncinate. *Flowers* with a pedicel 2-4 mm. long, pilose, the bracts very small, triangular; calyx ca. 4.5 mm. long, the lobes elliptic, acute, ca. 3.5 mm. long and 2-2.5 mm. wide, membranous, glabrous; petals ca. 5.5-6 mm. long, the limb ca. 1.5 mm. long and 1 mm. wide, bilobate at the apex, the appendage clavate and ca. 4-4.5 mm. long, the upper part of the limb and the lower part of the appendage sparsely ciliolate; anthers very shortly stipitate, ca. 0.25 mm. long, 2-thecate; staminodes 3-lobulate, the central lobe caudate and ca. 0.25 mm. long, the 2 lateral ones rounded and very small; ovary more or less globose, 5-lobulate, ca. 0.5 mm. in diam., muricate; style ca. 0.25 mm. long; stigma obscurely 5-subdenticulate. *Capsule* ca. 2.5 cm. in diam., the body more or less globose, 5-lobed, ca. 0.5 cm. long and 0.7 cm. in diam., densely spinose, the spines of various length, up to 1.2 cm. long; seeds ca. 3 mm. long and 1.5 mm. wide.

A variable species of tropical Central America and northern South America; usually in wet habitats, often in second growth. Colloquial names reported in Panama are *espino hueco, zarza, rabo de iguana* and *rangay*.

BOCAS DEL TORO: region of Almirante, Research Grounds, *Cooper 94;* Changuinola Valley, *Dunlap 280, 376* vicinity of Chiriquí Lagoon, *von Wedel 1066, 1127, 1240, 1241, 1276.* CANAL ZONE: along road to Battery VII, area west of Limon Bay, Gatun Locks and Gatun Lake, *Johnston 1776;* hills west of the Canal, near Gatun, *Standley 27269;* shore of Gatun Lake, east of laboratory, *Wetmore & Abbe 8a;* Barro Colorado Island, *Shattuck 374, 734, Standley 31466, Wetmore & Abbe 8, Wilson 36*; between Gorgona and Mamei, alt. 10-30 m., *Pittier 2697;* Las Cascadas Plantation, near Summit, *Standley 25720, 29598;* around Culebra, alt. 50-100 m., *Pittier 2214;* Paraiso Station, *Hayes 22;* Pedro Miguel, *Piper 5509;* vicinity of Miraflores Lake, *P. White 275*; along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29181;* Las Cruces Trail, *Harvey 5042;* Camino de Corozal, *Bro. Heriberto 254;* Corozal, roadside, *Killip 3147;* Balboa, *Standley 25612*; between Madden Dam and Saddle II near Alahuela, 90-100 m., *Dodge, Steyermark & Allen 16509;* near Fort Kobbe, *Allen 2014;* Colón to Empire, *Crawford 508.* COCLÉ: Penonomé and vicinity, *R. S. Williams 369.* DARIEN: Marraganti and vicinity, *R. S. Williams 657;* vicinity of Yape, ca. 30 m., *Allen 851;* Chepigana, Tucuti, 50 ft., *M. E. & R. A. Terry 1390.* PANAMA: along the Corozal Road, near Panama, *Standley 26769;* Laguna de Portala, near Chepo, alt. 50 m., *Pittier 4591;* Taboga Island, *Standley 27096, 27849;* Taboguilla Island, *Miller 1995.* PROVINCE UNKNOWN: *Hayes 332.*

8. GUAZUMA Adans.

GUAZUMA Adans., Fam. Pl. **2:** 382. 1763.

Bubroma Schreb. in L., Gen. Pl. ed. 8, 513. 1791.
Diuroglossum Turcz., Bull. Soc. Imp. Nat. Moscou **25**(2): 157. 1852.

Shrubs or trees, deciduous, the hairs chiefly stellate. *Leaves* alternate, simple, petiolate, stipulate, the stipules deciduous, the blade often somewhat asymmetrical, dentate to serrate, 3- to 7-nerved at the base. *Inflorescences* axillary, cymose, pedunculate. *Flowers* hermaphrodite, pedicellate, bracteolate; calyx divided into 2 to 5 lobes at the anthesis, the lobes reflexed and pubescent outside, deciduous; petals 5, valvate, cucullate, unguiculate, the apex involute and provided with a long, deeply bifid, liguliform appendage; stamens 15, the staminal tube divided into 5 alternipetalous, triangular staminodes and 5 oppositipetalous groups of 3

filaments, the filaments short, geniculate at the apex, 1 free and 2 connate; anthers 2-thecate, the thecae divergent, extrorse, longitudinally dehiscent; ovary sessile or stipitate, ellipsoid to globose, with 5 minute geniculate lobes at the apex, 5-celled, the cells many-ovulate, the ovules biseriate; style filiform; stigma 1- to 5-parted, the lobes usually connivent. *Capsules* ligneous, muricate or bearing filiform appendages, indehiscent or imperfectly 5-valvate; seeds small, albuminous; embryo erect; cotyledons foliaceous, folded.

A neotropical genus of three species of which only one occurs in Panama.

1. GUAZUMA ULMIFOLIA Lam., Encycl. Méth. Bot. **3:** 52. 1789; Standley, Contr. U. S. Nat. Herb. **27:** *pl.* 52. 1928; Johnston, Sargentia **8:** 202. 1949.—Fig. 7.

Theobroma Guazuma L., Sp. Pl. 782. 1753.
Guazuma polybotra Cav., Ic. Descr. Pl. **3:** 51, *t.299.* 1796.
Bubroma Guazuma (L.) Willd. in L., Sp. Pl. ed. 4[i.e. 5], **3:** 1423. 1802.
Bubroma polybotryum (Cav.) Willd., Enum. Pl. Hort. Berol. 806. 1809.
Bubroma Invira Willd., loc. cit. 806. 1809.
Guazuma tomentosa H. B. K., Nov. Gen. Sp. Pl. **5:** 320. 1823.
Bubroma tomentosum (H. B. K.) Spreng. in L., Syst. Veg. ed. 16, **3:** 332. 1826.
Bubroma grandiflorum Willd. ex Spreng. in L., Syst. Veg. ed. 16, **3:** 332. 1826.
Guazuma Bubroma Tussac, Fl. Antilles **4:** 69. 1827.
Guazuma tomentosa var. *monpoxensis* G. Don, Gen. Syst. Gard. Bot. **1:** 523. 1831.
Guazuma tomentosa var. *cumanensis* G. Don, loc. cit. 523. 1831.
Guazuma Blumei G. Don, loc. cit. 523. 1831.
Guazuma grandiflora (Willd. ex Spreng.) G. Don, loc. cit. 523. 1831.
Guazuma Invira (Willd.) G. Don, loc. cit. 523. 1831.
Guazuma utilis Poepp. & Endl., Nov. Gen. Sp. Pl. **3:** 72, *t.283.* 1844.
Guazuma parvifolia A. Rich., Bot., Pl. Vasc. in Ramon de la Sagra, Hist. Phys. Pol. Nat. Cuba 190. 1845.
Diuroglossum rufescens Turcz., Bull. Soc. Imp. Nat. Moscou **25**(2): 156. 1852.
Guazuma ulmifolia var. *glabra* K. Schum. in Mart., Fl. Bras. **12**(3): 81. 1886.
Guazuma ulmifolia var. *tomentella* K. Schum. in Mart., loc. cit. 81. 1886.
Guazuma ulmifolia var. *tomentosa* (H. B. K.) K. Schum. in Mart., loc. cit. 81. 1886.
Guazuma ulmifolia var. *velutina* K. Schum. in Mart., loc cit. 81. 1886.
Theobroma tomentosa (H. B. K.) Gomez de la Meza, Anal. Soc. Esp. Hist. Nat. **19:** 217. 1890.
Guazuma Guazuma (L.) Cockerell, Bull. Torrey Bot. Club **19:** 95. 1892.
Guazuma Guazuma var. *ulmifolia* (Lam.) O. Ktze, Rev. Gen. Pl. **3**(3): 24. 1898.
Guazuma coriacea Rusby, Bull. N. Y. Bot. Gard. **4:** 332. 1907.

Tree 2-25 m. in height, the trunk 5-60 cm. in diam., the young branches tomentellous to puberulous. *Leaves* with a terete petiole 0.5-2 cm. long, tomentellous to puberulous, the stipules small and triangular, the blade ovate, ovate-oblong, oblong or seldom narrowly oblong, slightly to very much inaequilateral, rounded to cordate at the base, long-acuminate at the apex, ca. 6-16 cm. long and 2-6 cm. wide, membranous to chartaceous, sometimes subcoriaceous, the margins irregularly dentate to serrate, the upper surface shortly puberulous, seldom glabrous, generally scabridulous and sometimes somewhat lustrous, the lower surface puberulous to tomentellous, the pubescence either of only appressed hairs or of appressed and spreading hairs, 3- to 7-nerved at the base, the nervation reticulate and prominent beneath. *Inflorescences* thyrsiform, the ultimate axes scorpioid, the axes and bracts densely puberulous to tomentellous. *Flowers* with a pedicel ca. 3-6 mm. long;

calyx ca. 3 mm. in diam., divided irregularly into 3 lobes ca. 3 mm. long, densely puberulous to tomentellous outside and glabrous or nearly so inside; petals obovate, slightly bifid at the apex, ca. 4 mm. long (without appendage) and 2 mm. wide, the claw ca. 0.5-1 mm. long, the appendage ca. 5 mm. long and bifid for ca. 3 mm., yellowish, puberulous outside, glabrous inside; staminal tube 1.2-1.5 mm. long, glabrous outside, loosely puberulous and with simple hairs on the upper part inside, the filaments ca. 0.8-1 mm. long, the staminodes ca. 0.8-1 mm. long and loosely puberulous; anthers very small, reddish; ovary ovoid to globose, ca. 0.8-1 mm. long and 0.8 mm. broad, shortly puberulous especially on the upper half; style and stigma ca. 1-1.5 mm. long. *Capsule* oblong, oblong-ellipsoid to globose, rounded on both ends, 1.5-4 cm. long and 1.2-2.5 cm. broad, black at maturity, tuberculate, the tubercles short, stout and more or less pyramidal, puberulous when young, indehiscent (the tubercles separating irregularly at maturity to a greater or less degree), somewhat pulpy inside; seeds numerous, obovoid, ca. 2.5-3.5 mm. long and 1.8-2 mm. wide, the testa maculate.

A polymorphous species widely distributed throughout the American tropics; frequent in pastures and second-growth forest, usually on dry soil, sometimes on swampy soil, chiefly near sea level.

In his recent revision of the genus, G. F. Freytag (Ceiba **1**: 193-225, *pl. 1-4, figs.* 1951) considers that *G. ulmifolia* is composed of two separate species: *G. ulmifolia* and *G. tomentosa* H. B. K., the differential characters being the dehiscence or indehiscence of the capsules, the form of the base of the petals, and the form and pubescence of the leaves. Study of abundant material from Panama and Central America, however, does not permit me to agree with Freytag. I consider the variations of the petals and leaves as extreme variations within a single species, all intermediate stages being present, and I believe that the capsule is always indehiscent or sometimes very incompletely loculicidally dehiscent.

The mucilaginous sap of the *guacimo* is used sometimes to clarify sirup in the manufacture of sugar and the bark contains a tough fiber employed for cordage; the capsule contains a small quantity of sweet edible pulp.

BOCA DEL TORO: region of Almirante, *Cooper 354*, *Cooper & Slater 20;* Changuinola Valley, *Dunlap 145a;* vicinity of Chiriquí Lagoon, Cocoa Cay, *von Wedel 2875;* vicinity of Chiriquí Lagoon, Johns Creek, *von Wedel 2764;* vicinity of Chiriquí Lagoon, *von Wedel 1183, 1269A, 1324.* CANAL ZONE: Isthmus of Panama, *Hayes 171;* area west of Limon Bay, Gatun Locks and Gatun Lake, road to Battery VII, *Johnston 1659;* near Frijoles, Río Agua Salud, *Piper 5870;* Barro Colorado Island, *Aviles 23;* second road past Summit, *Harvey 5181;* around El Paraiso, alt. 30-100 m., *Pittier 2579;* Chivi-Chivi Trail, 2 miles above Red Tank, *Maxon & Harvey 6572;* vicinity of Miraflores Lake, *G. White 183;* vicinity of Miraflores Lake, Cocoli Island, *P. White 305;* near Cocoli lighthouse, *P. White 92;* Corrosion Laboratory, vicinity of Miraflores Locks, *Stern, Chambers, Dwyer, Ebinger 79;* along the old Las Cruces Trail, between Fort Clayton and Corozal, *Standley 29012;* Ancon Hill, 600 ft. ele., *R. S. Williams 2;* Sabana of Panama, *Pittier 2547;* region of Balboa, *Johansen 5;* Madden Dam area near road, Transisthmian Highway, *Stern, Chambers, Dwyer, Ebinger 43;* Kobbe, *Harvey 5010;* locality unknown, *Christopherson 176.* CHIRIQUÍ: Progresso, *Cooper & Slater 315;* vicinity of David, 30-80 m., *Pittier 3368.* COCLÉ: Penonomé, *R. S. Williams 347.* COLÓN: vicinity of Gatuncillo, *Piper 5634.* DARIEN: Marraganti, *R. S. Williams 636;* near El Real, on edge of creek, *Stern, Chambers, Dwyer, Ebinger 457;* vicinity of Pinogana, ca. 20 m.,

Figure 7. GUAZUMA ULMIFOLIA Lam.: A, flowering branch (× ½); B, flower (× 4); C, petal from inside (× 4); D, androecium (× 5); E, gynoecium (× 15); F, capsule (× 1).

Allen 928, 4279. HERRERA: vicinity of Ocú, 100 m., *Allen 4058.* PANAMA: drowned forest near Vigia and San Juan on Río Pequení, 66 m., *Dodge, Steyermark & Allen 16560, 16569;* along the Corozal Road, near Panama, *Standley 26878;* Bella Vista, *Standley 25322;* along sea beach from Panama Vieja to Bella Vista, *Allen 828;* vicinity of Bella Vista, *Piper 5328;* Punta Paitilla, *Piper 5400;* between Sabanas and Río Yguana, *Macbride 2668;* Sabanas, *Bro. Paul 12;* near Tapia River, Juan Díaz region, *Maxon & Harvey 6615, 6619;* Taboga Island, *Hayes 612, Miller 1959, Pittier 3524, Standley 27084, 27977, Woodson, Allen & Seibert 1535;* San José Island, *Erlanson 76, 277, Johnston 353.* PROVINCE UNKNOWN: *Anderson s. n., Hayes 732, 796, Moore 33, Seemann 94.*

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PANAMA, PLANT COLLECTION, AND THE MISSOURI BOTANICAL GARDEN

JOHN D. DWYER

Nineteen hundred and sixty four marks the fiftieth anniversary of the Panama Canal, America's greatest engineering feat and the twentieth century's greatest boon to maritime commerce. As the Missouri Botanical Garden has been concerned directly with a scientific study of the vegetation of Panama since 1926, a brief review of botanical exploration would seem appropriate, with special deference being paid to those who carried plant presses and driers to this tropical crossroads of the world.

The "big ditch," located about 2000 miles as the crow flies from St. Louis, bisects the Republic of Panama, its forty mile length flanked on each side by five miles of leased Canal Zone territory and boasting an old-fashioned railroad whose cars clatter between the Canal's banks and the tropical brush. In a half century the six locks of the Canal and the immense man-created Gatun Lake whose waters flow to two oceans, have been an artery for some 300,000 vessels. The Republic, wedged between Costa Rica and Colombia, is a naturalist's paradise. Despite the fact that a small plane can fly from the Costa Rica boundary of the Isthmus to the Colombian boarder in about three hours, virtually every kind of ecological environment associated with the tropics is found: steaming rain-forests (of course during the rainy season), open savannas, montane forests, mangrove swamps, sandy beaches, and so forth. Darien, one of the ten Provinces of the Republic, still ranks among the world's most densely vegetated areas, lacking a single road and supporting only 2.5 persons per square mile, a goodly number of whom are scantily clad Indians with bodies daubed with the dyes of *Bixa* and *Genipa* fruits. The Atlantic side of the Isthmus, pounded by violent waves and fortified along its length by the Cordillera of Talamanca and the Cordillera of San Blas, which run like a series of vertebrae through the Republic and from which watery nerves flow to the sea, is virtually unknown botanically. Oddly enough the first herbarium specimen from Panama was collected in 1700 on the Caribbean side of Panama by James Wallace in the ill-starred Scottish colony of New Caledonia.

The Missouri Botanical (Shaw's) Garden, always famous for its collection of living plants, especially orchids, was attracted to Panama principally through the accomplishments of an orchidologist, Mr. C. W. Powell. At about the time of the opening of the Canal, Mr. Powell, living in Balboa, the "capital" of the Canal Zone, developed an intense interest in orchid culture. Extraordinary opportunities for collecting arose when American Army engineers created Gatun Lake by damming up the Chagres River. The taller trees, submerged in watery graves except for their orchidiferous branches, made harvesting easy for anyone willing to row a boat from the banks of the Canal. In addition, gravel roads to the interior of Panama were being slowly but surely improved. Soon the rain swept summits of orchid-rich Cerro Campana (Prov. Panama) and El Vallé (Prov. Coclé), a half day journey from the Canal Zone, attracted several collectors. The mountains in

the Province of Chiriquí, principally El Volcán (alt. 11,000 ft.), became a mecca for plant collectors, if one could stand the backbreaking bus ride of 300 miles. By 1917, Mr. Powell had 5000 orchids gracing his home. A few years later, a young but already renowned horticulturist, Mr. George Pring, en route from a plant collecting trip to South America, visited the Powell treasure house. So glowing were his reports to the Board of Trustees of the Garden that negotiations with Mr. Powell were initiated and by 1926 the Missouri Botanical Garden acquired the collection. This collection was housed in the Tropical Station, at the foot of Ancon Hill, a site granted to the Garden by the Canal Zone Government. Mr. Powell's tenure as Director of the Station was unfortunately short-lived as he died in the following year. Dr. George Moore, Director of Shaw's Garden, appointed Mr. A. A. Hunter as his successor, a post held until his death in 1936. Due to the high cost of operation, the Tropical Station was turned over in 1939 to the Canal Zone Government after being capably managed by the late Mr. Paul Allen.

As an adjunct of Shaw's Garden, the Tropical Station during its twelve years supplied the greenhouses in St. Louis with a continuous flow of living plants. From the Powell collection the Missouri Botanical Garden gained initially its world reputation in orchid culture; from its legions of living plants 75 or more new species of Panamanian orchids were described.

The closing of the doors of the Tropical Station served only to open another area of interest in Panama, i.e., the systematic collection of Panamanian plants for permanent deposit in the herbarium at the Missouri Botanical Garden, already boasting of over a million sheets from every corner of the world. These dried specimens were to serve and have served as the foundation for the grand floristic survey of the Isthmus being published family by family as the Flora of Panama, the first fascicle of which appeared in the *Annals of the Missouri Botanical Garden* in 1943. What has been accomplished in terms of this project may be seen in the list of the families of Spermatophytes in this issue of the *Annals* (p. iii-iv). As early as 1922, Dr. Greenman, Curator of the Herbarium at the Garden, made a few collections of phanerogams in Panama. Beginning in 1934, up to the advent of World War II, however, teams of botanists from the Garden and from the Henry Shaw School of Botany (Washington University) scoured the Isthmus for herbarium specimens. These included Paul Allen, Carol Dodge, Russell Seibert, Robert Schery, Julian Steyermark, and Robert Woodson. Associated with the Garden's botanists in several field trips was Dr. G. W. Martin of the State University of Iowa.

While the Missouri Botanical Garden has been identified closely with the Flora of Panama since 1926, the actual number of collectors dispatched thence under the auspices of the Garden has been obviously small, considering the botanical history of Panama. Between 1948 and the present time no one from the Garden, except myself in 1959, was sponsored formally on a field-trip to Panama. Approximately 175 botanists have collected phanerogams in Panama since 1700 (Appendix 1).

Reference must be paid to collectors (mostly Europeans) who functioned long before the Missouri Botanical Garden was founded or to others who were collecting

immediately before the Missouri teams arrived in Panama. Luis Nees (1790), Thaddeus Haenke (1790), Johan Bilberg (1826), Hugh Cuming (1829), Richard Hinds (1837), George Barclay (1837), Andres Sinclair (1837), Berthold Seemann (1847-1848), Julius von Warscewicz (1859), August Fendler (1849-1850), Mina Halsted (1844-1850), Edward Duchassaing (1849-1851), and Sutton Hayes (1860) all collected in Panama (for the most part near Panama City) before the French arrived in 1880 to dig the Canal. Many of the collectors whose name occur on type collections made in pre-Canal days, e.g. Sutton Hayes, August Fendler *et al.* restricted their botanizing to Panama City, Colón (Aspinwall), and the future Canal Zone. Notable exceptions were: J. F. Cowell, J. H. Hart, W. R. Maxon, H. Pittier, C. W. Powell, B. Seemann, J. von Warscewicz, R. S. Williams *et al.* Standing head and shoulders above the others was the Swiss naturalist Henri Pittier who from 1910 to 1914 worked with the U. S. Dept. of Agriculture and the Smithsonian Biological Survey of the Panama Canal Zone, and in 1915 and 1916 served as Director of the Agricultural Station at Matías Hernandez in Panama City.[1] Pittier collected in more localities of Panama (over 50) than any other botanist and according to Standley (p. 47-48, *Flora of the Panama Canal Zone* (Contr. U.S. Nat. Herb. **21**: 48, 1928), he collected 4175 numbers. However, I do not agree with this statement. I estimate that Pittier collected about 1850 numbers in Panama falling into the numerical range of 1724 to 7348. The overall estimate of 1850 numbers I gleaned from an extant index file of species in Pittier's hand of his collections in Panama (the cards also list other collectors of the species, including data on localities). While it may be argued that Pittier did not enter all his Panamanian collections on the cards, my survey of Pittier's sheets of Panamanian legumes and *Malvaceae* deposited in the U. S. National Herbarium, a survey made independently of the index, checks out very well with the card file.

The opening of the Panama Canal brought unprecedented wealth to the Republic. The improved roads and the development of air transportation in the twenties beckoned plant collectors. George P. Cooper and George Slater of the United Fruit Co., invading the virgin forests and marginal fields of the banana plantations of Bocas del Toro in 1926 and 1927, an area virtually unexplored since J. H. Hart's botanizing in 1875, brought to the herbarium and wood anatomy laboratories of Yale University School of Forestry a small collection of about 133 numbers of trees and shrubs. From this collection, however, emerged an unusually high percentage of new species. In 1927 and 1928, Cooper, working alone, collected 330 numbers of plants in Bocas del Toro. Many novelties were described by a young taxonomist employed as an associate curator at the U.S. National Herbarium in Washington, already the leading authority on many groups of phanerogams in Mexico and Central America, Paul C. Standley. In November 1923, Standley departed for the Canal Zone and adjacent Panama. His whirlwind collecting trip of four months in the Canal Zone-Panama City-Colón area yielded 7000 numbers,

[1] The records suggest that Pittier did not collect in Panama in 1913. Two of his numbers (1724 and 6054) are dated 1906, the first a collection of *Cassia undulata* Benth. from Ancon, dated March 3rd.

chiefly of herbaceous plants. Fortified with these specimens he produced the aforementioned *Flora of the Panama Canal Zone*. In the following year, he spent a week on Barro Colorado Island; his collections laid the foundation for his *Flora of Barro Colorado Island, Panama* (Contr. Arnold Arb. Harvard **5:** 1-17, 1923). Except for Paul Allen, a professional horticulturist and plant collector from the Missouri Botanical Garden, Standley collected more numbers in the Republic of Panama (essentially in the Canal Zone) than any other botanist. Charles Piper's collection of 1000 numbers of flowering plants in ten days in the Canal Zone must represent a record of some sort, particularly when one considers the problem of drying specimens in this very humid area.

The creation of the Canal in 1914 marked the birth of Barro Colorado Island. It dominates man-made Gatun Lake, the largest artificial lake in the world; its majestic hills, clothed with a rainforest of cathedral-like trees festooned with lianas, welcomes the naturalists of the world. In 1923 the Institute of Tropical Research of the National Research Council established a biological station on Barro Colorado Island. Today, its well-equipped laboratories, library, and museum facilities are administered by the Smithsonian Institution. Dr. Robert Dressler, a former staff member at the Missouri Botanical Garden, is the resident botanist on the Island. A number of collectors (a few of whom are better known as zoologists) have confined their botanizing in Panama to the Island: E. C. Abbe, S. Avilles, W. N. Bangham, L. H. Bailey, E. Z. Bailey, F. Carpenter, M. A. Carleton, O. Shattuck, H. E. Stork, R. H. Wetmore, M. Wheeler, H. Woodworth, P. Vestal *et al.* The most important recent collection of phanerogams made on the Island was that of J. E. Ebinger (339 numbers) in the summer of 1960.

During the financial depression in the United States beginning in 1929, plant collection in Panama seemed to have suffered greatly. However, in 1934 the Missouri Botanical Garden assumed leadership in the collection of herbarium material from the Republic. It is appropriate to give some data concerning the activities of the teams of botanists whose collections were made from 1934 to 1947.[2] These years may be regarded as golden from the viewpoint of the Missouri Botanical Garden, for approximately 10,000 numbers of Panamanian plants were collected, principally in the Provinces of Chiriquí, Coclé, Darien, and Panama as well as in the Canal Zone.[3] The records indicate that Allen, working either alone or as a member of a team, collected about 7000 numbers; about 4000 of these he collected alone or occa-

[2] Presumably no collections were made in the war years of 1943 to 1946.

[3] The lack of official records at the Missouri Botanical Garden for the 1934 to 1947 collections made it necessary to examine hundreds of sheets to ascertain the approximate numerical limits of the annual collections of the teams or individuals. Records of a kind exist in the various reports to the Director of the Missouri Botanical Garden, published annually in the *Bulletin of the Missouri Botanical Garden*, as well as scattered throughout various numbers of the volumes; much of the information concerning collecting in Panama and accessions of Panamanian plants for the herbarium of the Garden is presented in sketchy fashion; at times the data are confusing, e.g. on p. 24 of vol. 24 (1936) of the *Bulletin* we read that some 3000 dried specimens were "procured by Woodson, Martin, and Seibert." In examining labels of herbarium material I found no indication that Woodson collected in Panama in 1935.

sionally with his wife, Dorothy Allen. This, apart from Standley's collections mentioned previously, constitute the largest ever made in the Republic. While Standley collected unicates and only in the general vicinity of the Canal, Allen collected in multiplicate, at the same time sampling more areas of Panama than any other previous collector, with the exception of Pittier.

The following is a list of the teams and individuals, sent from the Garden to Panama from 1934 to 1947; it includes the numbers collected by these (dotted lines preceding and following the sets of collection numbers suggest the possibility that additional numbers exist).

1934—Dodge, Hunter, Steyermark & Allen nos. . . . 16501 to 16887
1934—Dodge, Steyermark & Allen nos. . . . 16501 to 16861 . . .
1934—Steyermark & Allen nos. . . . 16877 to 17512 . . .
1935—Allen nos. . . . 121 and 130 . . .
1935—Dodge & Allen nos. . . . 17293 to 17412 . . .
1935—Hunter & Allen nos. 1 to 782 . . .
1935—Seibert nos. 1-642 . . .
1936—Allen nos. . . . 42 to 147 . . .
1937—Allen nos. . . . 152 to 363 . . .
1937—Woodson, Allen & Seibert nos. . . . 401 to 441 . . .
1938—Allen nos. . . . 758 to 1315 . . .
1938—Woodson, Allen & Seibert nos. . . . 735 to 1918 . . .
1939—Allen nos. . . . 1367 to 2088 . . .
1940—Allen nos. . . . 2111 to 2858 . . .
1940—Woodson & Schery nos. 1—1031 . . .
1941—Allen nos. 2280 to 2649 . . .
1942—Allen nos. . . . 2768 to 2953 . . .
1946—Allen nos. 3621 to 3686 . . .
1946—Allen nos. . . . 4052 to 5096 . . .

In the summer of 1947, the vast majority of 5000 specimens collected by Woodson, Allen and Seibert were lost in a fire in the Canal Zone. Some of the 1947 collections of Allen were made with his wife. Noteworthy but disconcerting is the fact that the label of *Allen no. 1* (*Paspalum conjugatum* Berg.) is dated 1936, considering Allen collected in 1935. A. A. Hunter's few collections of phanerogams are unnumbered.

In the summer of 1959, W. Stern, K. Chambers, J. Ebinger, all at that time associated with Yale University, and J. Dwyer of St. Louis University, collected 1222 numbers in Panama; for the most part these were gathered in several spots in in Darien (Boca de Cupé, El Real, Paya, Cana, Yaviza etc.), with small collections being made in all the remaining Provinces of Panama except Bocas del Toro, Los Santos and San Blas. The dried plants served as vouchers for the great number of wood samples collected. A few fossil plants were collected at Ocú, (Prov. Herrera). In the summers of 1961 to 1964, as well as in Dec.-Jan. of 1962-1963. the author collected about 3000 numbers, for the most part in multiplicate. All Provinces of

the Republic were reached at some time, except Chiriquí and San Blas. In 1960, J. Ebinger collected 1165 numbers in the Canal Zone, as well as in Chiriquí, Coclé, and Panama. James Duke in 1961 and 1962 made the largest collection of plants by one individual since Standley's 7500 numbers in 1926 and 1927. At this time Dr. J. Duke took leaves of absence from the staff of the Missouri Botanical Garden and under the auspices of the U.S. Army Research Office (Durham) at Duke University, collected 3200 numbers beginning with number 3500. These plants, deposited in the Missouri Botanical Garden, are for the most part, still unmounted, with only about one-half of the collection identified. Of the total of 3200 numbers, Duke collected 1314 numbers in 1961 in the Canal Zone, in the Province of Panama, and a limited number (nos. 4125 to 4259) in Darien. In the following year, he made important collections in Darien (nos. 4815 to 5490), including in the Río Pirre area (nos. 4955 to 4978; 5071 to 5105; 5185 to 5207) and on Cerro Pirre itself (nos. 5286 to 5383; 6588 to 6606), a mountain of over 1000 meters whose cloud-forest summits had been visited only by E. A. Goldman in the middle of the 19th century. The remainder of his collections were in the Province of Panama (nos. 6501 to 6518), except for 19 numbers collected at the airport at Irandi (Prov. San Blas). In 1963, Dr. E. Tyson studying bats in the Province of Chiriquí collected about 125 herbarium numbers.

The Panamanians themselves have contributed little in terms of collecting herbarium material; this is understandable, considering the lack of herbarium facilities in the Republic and the great humidity and insect population which characterizes so much of the Isthmus. In 1912 and 1913, two Christian Brothers from the Colegio de La Salle of Panama City, Bro. Celestine and Bro. Gervais made important collections in the vicinity of Panama City. Two other Brothers, Bro. Heriberto and Bro Paul, in the early twenties collected in the Prov. of Panama, and in the Canal Zone; Bro. Maurice collected in Chiriquí in 1938.

Half of the botanists from the Missouri Botanical Garden who pioneered in studying the phanerogams of Panama in the golden years from 1934 to 1947 are still very much alive today and professionally active. The deceased are: Mr. A. A. Hunter, Mr. P. Allen, and Dr. R. Woodson; the latter as Curator of the Herbarium at the Garden and Professor of Botany at Washington University, became the "Dean" among students of the flora of the Isthmus. Coincidently, Dr. Paul Standley, who competed with him for these honors, died in the same year (1963); even more striking is the fact that Paul Allen died in the same fortnight. Mr. George Pring, who made the initial visit to Mr. Powell in the Canal Zone in the early twenties, is as vigorous as ever despite the fact that he is retired from his post as Superintendent of the Garden.

The Epilogue

The future of plant collecting in Panama seems promising with scores of new species, especially in families like the Rubiaceae, Piperaceae, Gesneriaceae, awaiting discovery. Areas like the Caribbean slopes of the Serrania del Tabasará of Bocas del Toro, the southwestern flank of the Azuero Peninsula (Prov. Los Santos), both

faces of the Cordillera of San Blas, especially on the Atlantic side, the flood forests of the 120-mile-long Río Bayano (Prov. Panama) and the vast cloud-banked ranges of southern Darien (Serranía del Sapo, Sierra de Jungurura, Sierra de Pirre), spreading like fingers from the Colombian border into Panama, are certain to be richly rewarding.

The Province of Bocas del Toro has been collected only by P. Allen, G. E. Blair, K. Chambers, G. P. Cooper, V. C. Dunlap, J. Dwyer, J. H. Hart, H. von Wedel, G. Slater, and W. Stern. Two inviting waterways of the Province, the little explored Río Changuinola and the virgin declivities of the Río Terbe (Tararia) and other streams, drain the loftiest summits of the Cordillera de Talamanca of the Panama-Costa Rica border. The author's limited experience in the lowlands of the Azuero Peninsula, at least in the Prov. of Los Santos, raises skepticism as to the richness of its flora. On the other hand, the range of mountains forming a fortress (except for the Tonosi lowlands) between the Pacific Ocean and the southwestern part of Los Santos, is probably the most virgin botanical collecting ground in Panama on the Pacific side. Probably the most accessible and fruitful elevation in Los Santos will prove to be Cerro Cambutal. This mountain, 5000 ft. in elevation, lies about 14 miles up the Arenas River and is accessible on foot from Arenas, a village supporting a small air-field, less than 50 miles from Chitré (Prov. Herrera). The maintenance of a U.S. Hydrographic Station on the summit suggests reasonable accessibility. While the lowlands of the Province of Los Santos have been visited only by two collectors (Allen, Dwyer), my limited field experience there suggests that it is extremely arid and often fired-over hillocks and pastures leave little for the discriminating plant collector, except along the banks of the occasional streams. Not far distant from the tip of the Province of Veraguas as it lies in the Azuero Peninsula is the Isla de Coiba, Panama's Penal Colony. Presumably only three botanists have collected on this attractive island (B. Seemann, A. Mendez, and J. Dwyer). In view of the restricted clientele of Coiba, the visiting scientist is obviously limited in his peregrinations. Coiba is potentially a collector's paradise, although the prisoners scattered in small camps about the island, have extensive clearings for rice, corn, cattle etc.

As suggested previously, most of Panama's Caribbean coastline is virtually unexplored botanically. Its shores, receiving about 150 streams from the Cordillera de Talamanca, the Serrania de Tabascara, and the Cordillera de San Blas, are, it is true, accessible by boat. However, the rough waters of the Atlantic and the all too-frequent shelves of coral in the shallow water are formidable obstacles for navigation. The recently constructed road from María Chiquita (a few miles from the city of Colón) to Porto Bello open up a promising atrium to a village, which although in shambles, is a historical aorta from which trails, older than the conquistadores, spread in all directions. Only a few botanists have collected on the San Blas Islands (G. P. Cooper, J. Duke, F. H. Elmore, I. Johnston, H. Pittier). The closely knit confederation of Cuna tribes controlling the area, while welcoming tourists at special points, is not overenthusiastic about granting permission to those desirous of wandering through their forests.

Apart from the Province of Panama and the Canal Zone, the Chiriquí area

has been collected more extensively than any other segment of the Republic. Predictably few new species will be collected in the Chiriquí highlands. In Central Panama a network of new roads are making more accessible little-known villages in the lowland areas. The number of new species along these thoroughfares, in all probability, will be considerably scarcer than at higher elevations. One of the most accessible areas near Panama City is Cerro Azul, a low hill lying back of Tócumen Airport; it has a rich and to some extent, unassessed flora. A paved road leading to Goofy Lake near the summit continues into a gravel road bordered by rich woodlands; there at least 15 species of *Melastomaceae* may be collected without difficulty.

APPENDIX

Tentative List of Collectors of Phanerogams in Panama[1]

Abbe, E. C.
Allen, Paul
Alston, A. H. G.
Ames, L.
Andersson, N. J.
André, Floyd
Avilles, Silvestre
Bailey, E. Z.
Bailey, L. H.
Baker, C. F.
Ball, C. R.
Bangham, C. M.
Barclay, George
Barrios, F. R.
Bartlett, H. H.
Behr, H. H.
Billberg, Johan E.
Blair, G. E.
Bridges, Thomas
Brown, Majorie
Brown, E. F.
Calderon, Salvador
Carleton, M. A.
Carpenter, Frank
Celestine, Bro.
Chambers, Kenneth
Chardon Palacios, C. E.
Chickering, A. M.
Christopherson, E. D.
Christie, W. D.
Chrysler, M. A.
Clausen, R. T.
Cook, O. F.
Cooper, G. P.
Corman, L. R.
Correll, D. S.
Covich, Alan P.
Cowell, J. F.
Crawford, J. C.
Cuming, Hugh
Dahlin, Emil
Davidson, A.
Davidson, G. R. W.
Dodge, C.
Dressler, Robert
Duchassaing, E. P.
Duke, James
Dunlap, V. C.
Dwyer, John
Ebinger, John
Elmore, F. H.
Epplesheimer, Mrs.
Erlanson, C. O.
Fairchild, A. G. B.
Faull, J. H.
Featherstone, William
Fendler, August
Fosberg, Ray
Gaillard, D. D.
Gervais, Bro.
Gillespie, John W.
Goldman, E. A.
Greenman, J. M.
Greenman, M. L.
Grisebach, A.
Hadamard, J.
Haenke, Thaddeus
Halsted, Mina B.
Harlow, James
Harper, R. A.
Harrison, P. G.
Hart, John H.
Harvey, D. R.
Hayes, Sutton
Haynes, G.
Henderson, P.
Heriberto, Bro.
Higgins, J. E.
Hitchcock, A. S.
Hodge, Walter
Holdridge, L. R.
Howe, C. D.
Howe, M. A.
Hunnewell, F. W.
Hunter, A. A.
Hutchinson, P. C.
Johnston, I. M.
Kenoyer, L. A.
Killip, E. P.
Kluge, H. C.
Knight, Denis
Koch, Alex
Kuntze, C. E. O.
Langman, I. K.
Lasser, T.
Leopold III, King
Lindsay, Walter
Lipscomb, L. J.
Little, E.
Llaña, G. A.
Longfield, C.
Lucas, Allen
Macbride, J. F.
Martin, G. W.
Mason, Charles
Maurice, Bro.
Maxon, W. R.
Mell, C. D.
Mendez, A.
Muenscher, W. C.
Miller, Gerrit

[1] I feel certain that with further research, particularly in European herbaria, the list will grow to well over 200 collectors. The collection of but one specimen (viz. James Wallace) and its deposition in an herbarium entitles an individual to a place on the list.

Nees, Luis
Netting, Graham
Nickerson, N. H.
Ostenfeld, C. H.
Paul, Bro.
Petersen, N. F.
Pfau, R.
Piper, C. V.
Pittier, Henri
Porterfield, W. M.
Powell, C. W.
Pringle, C. G.
Purdie, W.
Read, Frank A.
Riley, L. A. H.
Roever, W. E.
Rose, J. N.
Rowlee, H. E.
Rowlee, W. W.
Seeman, Berthold C.
Sinclair, Andrew
Stark, M. C.
Schery, Robert W.
Schupp, W. A.
Seibert, R. J.
Sexton, Owen
Shafer, J. A.
Shattuck, O.
Slater, George
Smith, C. E.
Smith, H. H.
Standley, Paul C.
Starry, D. E.
Stern, William
Stevens, F. L.
Steyermark, Julian
Stork, H. E.
Terry, R. A.
Terry, M. E.
Tyson, Edwin
Valerio, Juvenal
Underwood, L. M.
Valentine, E. T.
Vestal, P. A.
von Hagen, Christine
von Hagen, Wolfgang
Wagner, Moritz
Woodson, Robert
von Wedel, H.
Wallace, James
Wallis, John
Warscewicz, Julius von
Weddell, H. A.
Welch, Winona
Wendland, J. C.
Wetmore, R. H.
Wheeler, Morton
White, Gene
White, Peggy
Williams, R. S.
Wilson, C. L.
Woodworth, H.
Zahn, Paul
Zetek, James

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